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Field Book of Marine Fishes of the Atlantic Coast

From Labrador to Texas

Being a Short Description of Their
Characteristics and Habits with
Keys for Their Identification

By Charles M. Breder, Jr.

Research Associate at the New York Aquarium
and the American Museum of Natural History

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With over 400 Illustrations

G. P. Putnam's Sons
New York and London

FIELD BOOK OF MARINE FISHES
OF THE ATLANTIC COAST

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by
Charles M. Breder, Jr.

Third Impression

Made in the United States of America

TO MY PARENTS

INTRODUCTION

Small sized volumes, more or less of pocket size, have long been familiar to the amateur naturalist. These have dealt with many subjects and their treatment and manner of approach has been various. Most of them have been issued in series or sets covering many diverse groups of organisms and it seems strange that this volume to the best of the author's knowledge and belief should be the first to treat of American fishes appearing in any such series.

There are many "library sized" treatises on American fishes of a popular nature and a vast number of anglers' books intended for either field or study use. None, however, of the books small enough to carry afield conveniently treat fishes as objects of other than sporting or gustatory interest. In short there are none comparable to those on birds, flowers, insects, et cetera, the approaches of which are those of a student interested in the various phenomena of nature. It is the purpose of the present volume to do for fishes what has been done in these other fields. That there is a demand for such information is evidenced by the constant stream of inquiries that flow to institutions concerned with fishes. The writer has been strongly impressed by this fact at the three such institutions with which he has been connected, namely, the United States Bureau of Fisheries, the New York Aquarium and the American Museum of Natural History.

The first knowledge concerning a given fish must concern its identity so that one may be able to intelligently discover what is already known concerning it. Therefore much of the present volume is concerned with the identification of the species found within the region treated. This unfortunately crowds the usually more interesting parts, but for studies afield the space devoted to it is doubtless thoroughly justified.

Much of the data covered herein is based on technical books and papers already extant but unavailable either as handbooks or to the amateur ichthyologist in any sense because of their technical nature. Such data digested and combined with new and original observation forms the bases on which this book rests. A hint of the rather large number of papers and books from which much of the data has been drawn is given in a bibliography at the back, page 313, which is intended for those who wish to go more deeply into the subject. These references can lead one as far into the science of ichthyology as one may care to go.

The present status of ichthyology in America, at least, forces me to make the following explanation intended purely for my professional colleagues in the study of fishes. That some such volume as this is desirable I feel all will agree and that any such attempt at the present time is certain to contain its share of errors is a foregone conclusion. However, the reasons for certain manners of treatment here employed may not be clear without the following remarks.

Owing to the lack of agreement and the constant shifting on matters of nomenclature it was thought best to adhere to the broader features as given in the now somewhat timeworn, but nevertheless classic "Bulletin 47." In the main this adherence has been carried down to the families, for while for technical purposes other more recent arrangements might be better, it is unquestionably clear, definite and is neither "hair-splitting" or "lumping" in nature. Also as it is hoped that this book may lead some of its readers further into the study of fishes it is believed that it might form a better connecting link with technical literature if in agreement with the not too recent practice.

On the other hand more recent practice has been followed in the matter of generic and specific names. This may be considered inconsistent but attention is called to the fact that the changes have been much greater here and of usually longer standing. They could not be ignored so easily. In any case, however, where nomenclatural exactness and a practical consideration crossed the latter was given preference.

I am indebted to J. T. Nichols, my good friend and frequent co-author, for reading the manuscript and for numerous valuable suggestions.

Of the 395 line cuts 88 are from "The Fishes of Port-au-Prince Bay, Haiti," by Beebe and Tee-Van. The remainder have been drawn by the author, 262 being taken from "The

Marine Fishes of New York and Southern New England" by Nichols and Breder and 45 new.

With this brief introduction we may discuss what group of animals is covered by the general term "fishes" and consider something of their manner of life.

C. M. Breder, Jr.

DEFINITION OF FISHES AND THEIR MANNER OF LIFE

In order to understand properly just what natural group of animals is referred to by the word "Fish" we may first consider the major groups of the animal kingdom. Of these, which are known as Phyla, there are about a dozen, depending on what classification we adopt. Only one Phylum need concern us. The others, including insects, crustacea, mollusks, worms, et cetera, or in short, all those that lack a backbone or vertebral column, are not within our province here. They are at once distinguished from it by lacking this vertebral column or backbone and include groups of animals quite different from those considered in this book. The Phylum (Chordata) which in part does concern us may be considered as possessing a vertebral column and not more than two sets of paired locomotor appendages.[1]

The Phylum Chordata, to which we ourselves belong, may, for practical purposes, be divided into five classes as follows:

The Fishes	Pisces
The Amphibians	Amphibia
The Reptiles	Reptilia
The Birds	Aves
The Mammals	Mammalia

Our present interests center on the first, or most primitive, and geologically the most ancient class, the fishes. This class is at once set off from the rest by the fact that the paired appendages are not attached to the body by articulated limb bones as seen in mammals, birds, reptiles or amphibia, nor are these appendages terminated in the typically five, or seldom less, articulated digits of the higher vertebrates.

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[1] This definition is intended purely for the novice and takes no cognizance of the lower "borderline" Chordata. Reference to any current zoological text or encyclopedia will explain those details not discussed here.

For this reason all the vertebrate animals other than fishes are sometimes grouped together under the heading tetrapoda or four-footed creatures, the wing of a bird and the hand of a man being of course included in this as the bony elements are homologous.

Having now narrowed our view down to the non-tetrapodus vertebrates or fishes we may discuss just what are the positive characters of fishes, having now considered some of the negative, or characters which they lack.

Before doing this, however, we may consider two small groups of fish-like animals which are discussed in this and most books on fishes, although when carefully analyzed they can hardly be considered as true fishes. These groups are often considered as a distinct class. The first group is composed of small, transparent, almost worm-like creatures in which the mouth is a longitudinal slit, the Leptocardii. The second group is composed of eel-like creatures, devoid of any paired fins and without articulated jaws such as are possessed by true fishes and all higher vertebrates. In place of the jaw there is a buccal cavity of an approximately circular outline, armed with horny teeth-like processes. They may be blind or may have poorly developed eyes. They are mostly semi-parasitic, boring into the bodies of living fishes and extracting nourishment until their unfortunate host dies of exhaustion and injury.

With this preliminary discussion we may consider fishes proper. For the purposes of this book they may be defined as aquatic, cold-blooded,[1] jaw-bearing vertebrates, breathing chiefly by means of gills and having the paired limbs represented by fins. In addition to this there is usually a developed dermal exoskeleton, consisting of the scales and flat plate-like bones about the head. The jaws as well as various areas inside the mouth and gullet usually bear true teeth.

Just as vertebrates are an exceedingly diversified assemblage, so are the fishes themselves. Indeed, there seems to be little similarity between such forms as the common goldfish, the sea horse, and the eel. However, they all fit in the above definition and numerous other details of similarity might be discussed but which we need not consider here. We may now list the divisions of the fishes which are to be encountered in our range.

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[1] Cold-blooded is only a comparative term and really refers to animals which lack a definite body temperature regardless of external conditions. That is, their temperatures fluctuate with that of the surrounding medium, although it is usually a little higher. A better term is poikilothermal as opposed to homoiothermal animals (the birds and mammals) which normally maintain a constant and definite body temperature.

The Lancelets—*Class Leptocardii*

A small group of fish-like vertebrates. They are distinguished by the lack of a distinct brain, eyes, jaws or paired fins. The mouth (buccal cavity) is surrounded by a circlet of cilia. There are no external gill clefts marking the posterior end of the "head."

The Lampreys—*Class Marsipobranchii*

This small group of fish-like vertebrates may be distinguished by the possession of a suctorial mouth without jaws, by a single median nostril and the absence of paired fins.

The True Fishes—*Class Pisces*

Aquatic, jaw-bearing vertebrates in which the chief organs of respiration are gills. Further definition of this great group will be found under its various subclasses below and in the preceding general discussion.

The Sharks and Rays—*Subclass Elasmobranchii*

This group includes the well known sharks, skates and rays. It may be recognized as distinct from other groups by the possession of no true bone. That is, the skeletal framework is essentially one of cartilage which may be strengthened by calcification but never by ossification. There is a distinct difference between cartilage stiffened by the presence of calcium salts and the elaboration of bone with its osteoblasts, haversian canals and other microscopically differentiable details. Also these fishes if armored are covered with shagreen, which consists of teeth-like enamel denticles, which are quite different from the scales of bony fishes. The gills communicate with the exterior by a series of slits (5 to 7) and are not protected by a plate, the operculum of the higher fishes. The anus and urogenital aperture open into a common duct, the cloaca.

The Chimeras—*Subclass Holocephali*

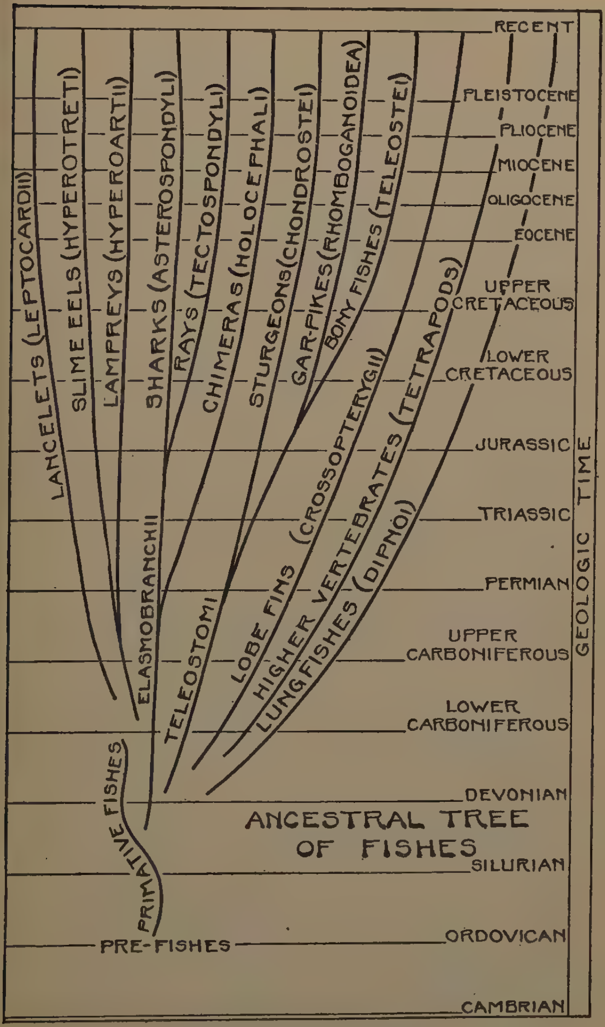
This small group resembles the sharks and skates in many ways. In general form the body is shark-like, but the compressed head and small mouth are distinctly different. Also there is a single gill cleft instead of a series. It differs from the following groups in that there is a fold of skin that forms the gill cover instead of a bony plate. The anus and urogenital aperture open separately to the exterior.

The Bony Fishes—*Subclass Teleostomi*

The bulk of present day fishes are encompassed in this group. They are highly diversified but are distinguished from the preceding groups in the possession of a skeleton of true bone as in the higher vertebrates, by having the head invested in a complicated series of dermal bony plates, and by the possession of bony instead of horny fin rays. As in the chimeras, the anus and urogenital pore open separately to the exterior.

With this brief description of the characteristics which differentiate fishes from the other backboned animals we may consider a few of their more outstanding qualifications to cope with life and their general relationships to the world about them. The habits of fishes make an interesting study and as much of them have been included in this book as space allowed.

Geologically speaking they are the oldest vertebrates known, their line thundering back to Ordovician time. A conception of our ideas concerning the coarser relationships of the great groups of fishes is shown on the opposite page. Just how the backbone was developed and from what type of invertebrate animal is still a question for profound discussion and is one of the most puzzling of the more important



EVOLUTION OF FISHES

Diagram of the most generally accepted views of the relationships of the various major groups of fishes with regard to geological time.

questions in modern evolutionary philosophy. All the higher forms of vertebrates, the tetrapods, quite clearly arose through some fish-like form. The group which evolved the first true limb we believe to be some primitive crossopterygian. There are but two representatives of this group still extant and both in the fresh waters of Africa.

Wherever water occurs on the surface of the globe fishes may be expected to be found, ranging from arctic waters right down to the freezing point to the hot springs of our southwest, or from brilliantly illuminated coral reefs to the perpetual night of the underground water of limestone caverns. Although some species are able to sojourn for various periods of time out of water they are all so dependent upon it that eventually they must resort to it, and, of course, by far the great majority are distressed by even a short removal from it.

Addressing ourselves to the fishes discussed in this book we find certain of them confined to particular parts of the sea and unable to survive for long in any others. Some we find capable of making long journeys, self-reliant and tolerant of a wide variety of conditions. Some are even indifferent to salt or fresh water and consequently we find them in both streams and the ocean. Some even make yearly migrations to or from fresh water for the purposes of reproduction. In the former class we have the various salmons and to a lesser degree the shad and striped bass. These types, which ascend streams for the purpose of spawning, are known as anadromous fishes. The eel on the other hand spends much of its life in fresh water and descends to the sea to spawn. Such types are known as catadromous.

Most fishes deposit eggs but a variety of different sorts give birth to living young. On our coasts we have such diverse groups as some sharks and rays, some killifishes and some gobies which have this latter characteristic. Viviparity, the giving birth to live young, in fishes does not represent such a fundamental difference from oviparity, the laying of eggs, as might be first assumed. It is for the most part a question of which happens first, the hatching of the egg or its expulsion from the body of the female. A greater difference is apparent in the males of such species for in the case of the viviparous forms, special provision must be made for the fertilizing the eggs within the body of the female, whereas in the oviparous forms both eggs and milt are simply passed out into the water where they mix and where fertilization takes place. In the case of the sharks and rays the ventral fins are modified into an organ for this purpose and in the killifishes the anal fin is so modified.

Of the egg laying species, by far the greatest number take no bother with their eggs after they are deposited, but certain others engage in various interesting practices to insure the protection of the hatching eggs and larvæ.

Fishes subsist on a variety of foods, comparable to their variety in structure. By far the greatest number are carnivorous but they range all the way from those which will only feed on living, moving organisms to those which are content with carrion or offal. Some even subsist entirely on algæ scraped from submerged rocks. Certain species are exceedingly particular in their choice of foods, actually starving to death in the absence of just the right morsel, and others are so omnivorous that they will swallow practically any object, including such indigestible things as tin cans, bottles or other human artifacts. This is especially true of some of the sharks.

The development of the senses in fishes is likewise varied. Some kinds have a highly developed chemical sense, including taste and smell, and find their food chiefly by such means. Barbels about the head of a fish are almost sure to be covered with taste buds and function in locating foods. Other species depend largely on vision for such purposes. The vision of fishes is a fascinating subject but too involved to be discussed at length here. Suffice it to say that the fish eye is comparatively near sighted but is supplied with an extremely wide angle lens enabling them to see in nearly every direction at once. This is complicated by the peculiar conditions of vision under water, due to refraction, reflection from its under surface, et cetera.

Hearing is well developed in most fishes although there is no external ear. Such is probably unnecessary because water itself is such an excellent conductor of sound, as, being only very slightly compressible, it does not have the cushioning effect on sound waves that air does. In other words the drop in intensity with distance is much less in water than air.

For this same reason mechanical vibrations are also transmitted readily and except under experimental conditions it is hard to be sure just which is more perceptible to the fish as they are usually both produced by a disturbance that will produce one.

As pointed out previously the form of the fish body is very diversified. These differences are naturally closely connected with the habits, especially the natatorial ability of a species. If a fish is to be capable of rapid swimming its body must be somewhat fusiform, that is "stream line" for the average speed it is to move at. Fishes of such a form with a large squarish tail are capable of powerful swimming for short periods. Such fishes with the tail cut away in the middle, *i.e.* widely forked, are capable of high speed maintained for a long time—the apex of locomotor ability. Species of other than fusiform bodies are necessarily slower and frequently have large, more or less spatulate tails. These are chiefly used as rudders, the driving engine usually being located elsewhere. That is to say, fishes of the first type use flexures of the body cumulating in the tail for driving themselves forward whereas the latter are more given to using the pectorals or other fins for that purpose. Elongate snake-like fishes use movements similar to those of the first but continued over their long slim bodies into multiple waves. Fishes that do not depend on speed for escape from enemies or the pursuit of food have frequently gone in for the development of armature in the form of bony plates, spines or other processes that make high speed an impossibility.

Most fishes have a specific gravity equal to that of the water they live in so that gravity, as we know it, is non-existent for them. This stability is regulated largely by a bladder containing gas, the swim-bladder, which is located about the fish's center of gravity. Most forms that are not so equipped rest on the bottom, being heavier than water, although there are a number which provide for flotation otherwise.

A number of fishes are capable of the production of sound, usually by the vibration of the swim-bladder, which acts as a resonating chamber. In certain forms only the male fish are able to make sounds which they do only before the spawning season. It would seem that such voice is not dissimilar to the voice of male birds in function. At any rate there is good evidence that sound is of considerable significance in the lives of fishes despite the popular idea to the contrary.

There can be little doubt that the mental life of fishes is of a lower order as compared with the higher vertebrates. Most of their acts can clearly be referred to direct and rather simple response stimulus.

THE GEOGRAPHIC RANGE AND TYPES OF ENVIRONMENT INCLUDED

The range included in this field book reaches from the cold boreal waters of Labrador through the temperate seas of our Atlantic Seaboard down into the warm tropical waters of the Gulf of Mexico to our southernmost state. It is at once evident that along such a coast line, extending roughly some four thousand miles in a nearly north and south direction, we would find a great diversity of habitat and consequently a correspondingly diversified assemblage of fishes. An offshore limit has been set at the twenty-five fathom mark, as the book is concerned with the so-called shore fishes, and as far up-stream, on the shoreward side, as brackish water reaches.

In preparing a faunal list of this nature it is usually difficult to decide just where to stop. This difficulty is particularly acute in considering oceanic animals, for here natural boundaries, barriers and other limits, although present, are particularly vague and many of them shift with the season. Among them are such factors as temperature, direction and strength of currents, depth of water, proximity to the shore line, its character, tides and the type of bottom.

We may briefly consider the more prominent types of coastal habitats within our range under the general heads of boreal, temperate and tropic.

Boreal region.—The coastal waters which we may consider here as boreal reach from Labrador to about Cape Cod. This peninsula serves to deflect seaward the north bound Gulf Stream coming up our coast from the West Indies so that coastwise we have a rather abrupt transition to the cold arctic waters of the south bound Labrador current. This affects the environmental conditions so that the fishes north of this point, excepting rare stragglers, belong largely to the circumpolar arctic forms. The bottom is characterized by rocky formations in which sandy bottoms are relatively few in comparison to the more southern regions. Tides are of considerable magnitude and inlets in the nature of fjords are common. Vegetable growths are relatively sparse, but small food organisms of a planktonic nature are abundant.

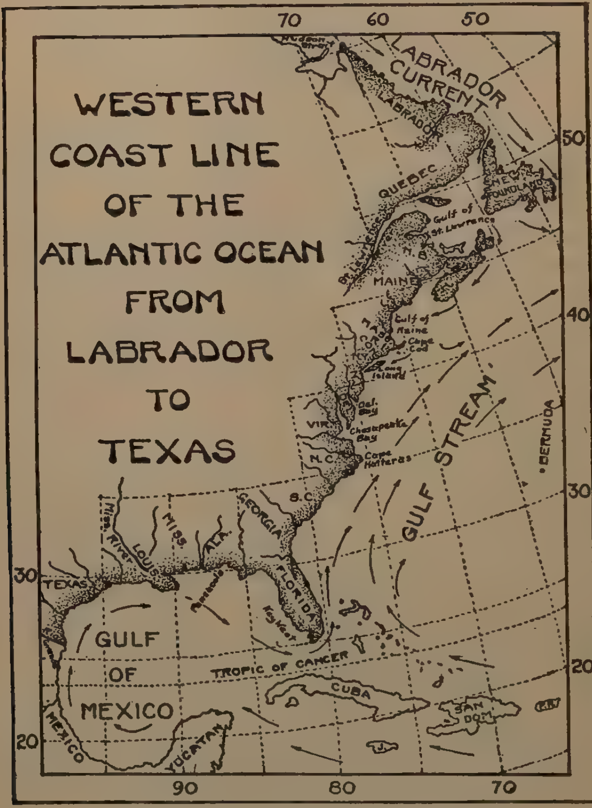


CHART OF COAST LINE

The offshore limit, twenty-five fathoms, is not indicated as on a chart of this scale it is in most places too close to the shore line to be distinct. The shores covered in this volume are stippled.

Temperate region.—The temperate waters may be considered as reaching from Cape Cod southward and very gently merging with the truly tropical waters south of Cape Hatteras.

Here a great diversity in both seasonal and incidental variation is met with. The Gulf Stream is of great influence on the fauna, being considerably off the coast in some places and almost lapping the shores at others. This element shifts from year to year as well as seasonally, making for exceedingly variable faunal conditions which are usually difficult to predict. The accompanying chart indicates what might be considered the "normal" course of the Gulf Stream. A much greater variety of bottom is encountered along this stretch of coast, including sandy, gradually sloping shores, swept clear by current and tide or clogged with masses of aquatic vegetation which pass insensibly into salt marshes. Rocky shores are scattered and few and in places the sandy beaches are replaced by mud flats. The tides, while not as great as those to the northward, are still of considerable magnitude and vary greatly in time and depth due to the sunken coast formation which provides a great number of estuaries, bays, sounds and inlets. These are fed for the most part by rivers of considerable aggregate volume which lower the salinity to the point where they, in many instances, can be thought of but as little more than brackish. Today man has added another factor to this complex which has already assumed tremendous significance in the life of coastal fishes. Wherever he has congregated in great numbers, the amount and nature of the materials carried to sea by the adjacent rivers have been modified to a great extent. Under ordinary conditions the by-products of the land have been a stimulus to life in the seas and for many forms, directly or indirectly, of great significance. Unless concentrated in exceedingly thick solutions, the household wastes of mankind have become a part of this and have also been taken care of. But when this becomes so great in mere bulk, and there is added to it a variegated variety of factory wastes which for a large part are crude chemicals of a toxic nature unavailable as food for any organism no matter how primitive or specialized, we have another problem. The fishes are confronted with a changed environment and they may either adapt themselves to it or vanish. As we know of no organisms that can flourish on toxic chemical wastes, there is but one result possible, at least as far as the recent generations of man are concerned, —a depletion of coastwise life in the affected areas. This is mentioned here because its effects are most noticeable along the temperate shores where our great cities have grown up. The only other factor of significance that man supplies in the economy of coastwise life is also most in evidence along the temperate shores. I refer here to his direct efforts as a predatory animal in search of food. Although this search carries further away from home than the disposal of his wastes, still his fishing expeditions naturally radiate from his present centers of abundance.

For long there have been controversies between the commercial fisherman, obtaining fishes by the ton which eventually become household staples for all of us, and the sportsman angler who sees in his sport a health-giving relaxation that is of great significance to him and his fellow followers of Izaak Walton. He is very apt to feel that the commercial fishermen with their great "gear" and their methods of "mass production" are slowly but surely depleting the seas and making it progressively more difficult for the angler to catch himself enough fish in a day for his own satisfaction. He is wont to point out that every fish taken from the sea is one less in it and that the young fish destroyed by the nets of commercial fishermen were all potential "whoppers." From here he will go on to point out how our streams and ponds have been fished out and what fish culture has subsequently done for them and that the former is now progressing on a gigantic scale in the ocean. The commercial fisherman is apt to reply to the effect that the ocean is actually more than an overgrown mill pond and that generalizations based on fresh water conditions cannot be extrapolated to apply there, and that after all if they could, the small impression that mere man could make on the oceanic fauna is only a trifle. He further likes to take historic cases where fishes have appeared suddenly in great numbers after long continued absences or disappeared where practically no fishing has been carried on.

However, it is not the purpose of this book to embroil the author in a discussion of the relative merits of the two points of view, interesting a subject as it may be. This is partly because it would overstep the bounds which circumscribe this volume and partly because the author is a representative of still a third class, being neither angler nor commercial fisherman, but concerning himself with the fish as an object susceptible of philosophic research. He has felt, however, that this bare statement of a very practical controversy should be made for the benefit of some neophyte ichthyologist that might chance upon this volume, as it has often become a subject for politicians to wax rhetorical over in our law-providing bodies and if we were primarily a fishing nation instead of an agricultural and industrial one, it would doubtless mount to a position of national significance.

Tropical region.—South of Cape Hatteras we merge gradually into the truly tropical coastal waters, until on the sandy shores and mangrove inlets of Florida we find essentially tropical conditions which continue with various local modifications around its tip and up the west coast and into the Gulf of Mexico, finally reaching our arbitrary southern limit at the national boundary with Mexico. In this area we frequently have water of crystal clearness where the bottoms may be observed with ease in depths of fifty feet or over. The shore line proper is for most part of fine soft calcareous sand composed of fragments of coral, but usually about river mouths mangrove swamps abound. The vicinity of the mouth of the Mississippi is, of course, well known for its dark water and soft alluvial bottom. This type of habitat affords shelter for many small fishes that would find difficulty in swimming in the open waters or about coral reefs where the competition is particularly severe. These reefs, which may fringe the shore in a parallel line, commonly breaking the surface in places, are particularly fascinating to the student of fishes, affording a suitable habitat for many bizarre, gaudily colored, or even beautiful fishes. Between the coral heads and in other places, luxuriant growths of vegetation form the basis of still other types of associations. The warm Gulf Stream originating in the Gulf of Mexico and passing northward around the tip of the Floridian peninsula sweeps up the east coast between Miami and the Bahamas. It is of high salinity due to the great amount of evaporation despite the lowering effect that the Mississippi and Rio Grande have on it almost at its source.

THE IDENTIFICATION OF FISHES

By reference to the section defining fishes, page ix, we may decide whether or not an animal in hand is a fish or not. In most cases this is so evident that a simple glance will suffice to detect the essential characteristics. There are, however, some animals which, to the novice at least, will present some little difficulty, such as certain porpoises (mammals) which have a very fish-like form, certain marine worms, such as *Saggita*, which somewhat resemble the lancelets. Moreover, on the other hand, there are forms that superficially resemble other groups more closely than they do the conventional idea of a fish. For example some of the brightly colored tropical eels are very suggestive of snakes.

After having decided that we actually have a fish to deal with we will want to know the procedure necessary to determine just what group of fishes it belongs to and finally exactly what species it is. For this purpose we must familiarize ourselves with a limited number of technical terms to avoid unduly verbose keys and descriptions. All the terms used in this book are explained in a glossary in the back, page 305. In addition there is given herewith a diagram naming the chief parts in the external topography of fishes.

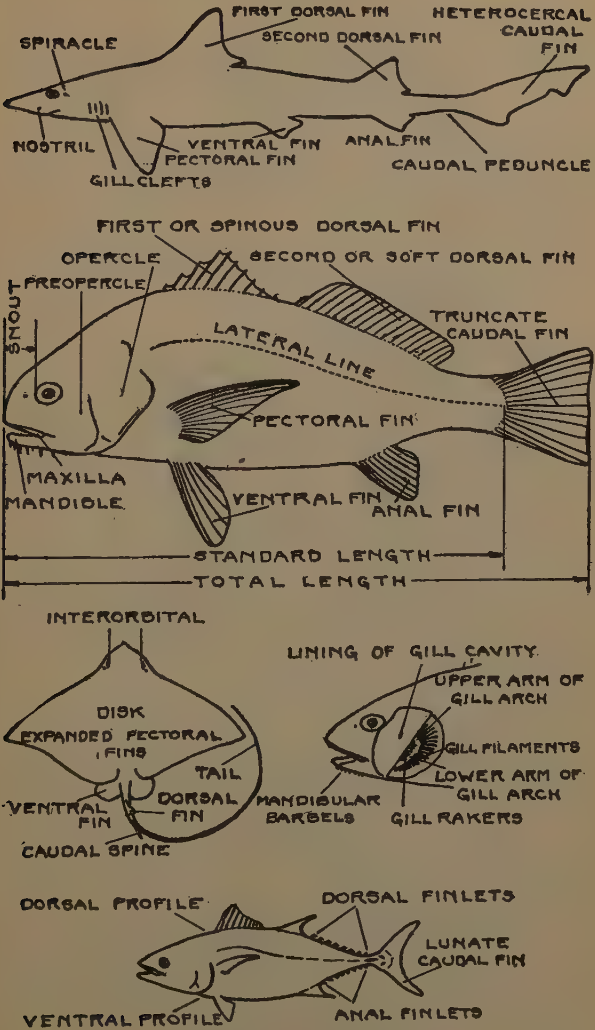
The number of spines and rays in the dorsal and anal fins and the number of transverse rows of scales crossing the lateral line are used frequently in differentiating between two close species, as these scale counts have been found to be relatively constant. The number of supporting rods in the dorsal and anal fins are most readily given as a formula. Thus roman figures indicate spines and arabic indicate soft flexible and usually branched rays. If the fin is in two parts a dash separates the numbers and if connected by a membrane a comma. Thus in the weakfish (*Cynoscion regalis*) which has two dorsal fins, the formula reads X—I, 27; whereas in the spadefish (*Chætodipterus faber*) with a single dorsal fin, it reads IX, 23. The gill rakers, bony processes on the bone supporting the outer series of gills, are also used for purposes of differentiation. They may be seen by lifting the gill cover (operculum). These are usually counted from the upper angulation to the foremost point they reach along this bone (on the first gill arch), or those above and below this angulation may be counted separately with a "+" intervening.

All measurements are taken proportionally, that is, the length of the head or depth of the body is referred to the length of the fish without the tail fin. This is done for practical reasons as the tail fin is frequently mutilated or variable on account of other incidental reasons. Thus in reading of head 3.4 and depth 4 as of the kingfish (*Menticirrhus saxatilis*) it means that those measurements, as laid off by a pair of dividers, along the horizontal axis of the fish from the tip of the snout to the base of the tail fin, are contained in that length 3.4 and 4 times respectively. The eye, snout and other parts of the head are similarly understood to refer to the length of the head instead of the body. It is evident that absolute measurements in inches or centimeters is of value only when referable to the length of the fish.

Coloration in fishes, for most part, is of little assistance in identification as most fishes are capable of considerable change of color and fade or are otherwise greatly modified on death. The pattern, that is the shape of the pigment areas, is also subject to extensive change but usually not to nearly the extent of the shade of the colors themselves. It is therefore more apt to be reliable within limits, but the most fundamental characters are, of course, matters of structure such as the character of the teeth, scales, et cetera.

Aside from the fact that larval fishes are usually very different from their parents, the small specimens of a given species are usually somewhat different proportionally than the larger. For example in small specimens the eye and head is usually relatively larger and the fins are proportionally higher. However, the number of scales and fin rays usually remain constant throughout life.

A key follows which should enable one to place a specimen within its proper order. In using the key the description opposite the first letter is compared with the specimen. If it agrees with the description the letter under it is compared and so on until one is encountered which does not agree.



EXTERNAL TOPOGRAPHY

Diagram naming the principal external parts involved in identifying fishes.

Then its double is located which should agree and the process is continued until some letter is reached that has a description followed by the name of an order and a page reference. This page is then turned to and the key under it followed and so on. The profusion of line cuts should help materially at this point and keep one from wandering far afield as a result of possible misinterpretation of the finer drawn distinctions.

KEY TO THE ORDERS OF MARINE FISHES OF THE ATLANTIC COAST

The following key is intended to assist in placing an unknown fish within its proper order. The key is purely artificial, attempting nothing of an analysis or the showing of natural affinities, and is constructed with the sole intention of aiding the amateur in the preliminary stages of identification. A little familiarity with fishes will enable one to place most species in their proper order without reference to this key. For example almost anyone could place a skate without the slightest hesitation. However, there are some forms that only the professional or experienced amateur could be expected to locate readily. This difference is largely a matter of consciously or unconsciously remembering the characters used in this key. The definitions purposely apply only to the forms known to occur in the region treated. External characters have been used throughout in preference to the often more fundamental internal characters.

A. Mouth a simple oral opening, more or less inferior in position, without jaws, either a longitudinal slit or a circular opening; no paired fins.

The Lancelets (*Class Leptocardii*)

B. Mouth a longitudinal slit, edged on either side with cirri; no distinct brain or skull; skin naked; transparent; gonads multiple; eyes rudimentary; blood colorless; animals small, less than 3 inches long; compressed and lanceolate in outline; no lateral gill openings. *The Lancelets* (*Order Amphioxi*), 3.

The Lampreys (*Class Marsipobranchii*)

BB. Mouth nearly circular in outline and armed with horny "teeth" and suctorial in nature; a distinct brain but an imperfectly developed skull; not transparent; a single pair of gonads; eyes rudimentary or not; blood red; animals eel-like in shape; one or multiple circular gill openings which are lateral; up to about 3 feet in length; a single median nostril.

C. Mouth surrounded by a number of barbels; a single dorsal fin; eyes not developed; nasal tube penetrating palate; gill openings single. *The Slime Eels* (*Order Hyperotreti*), 4.

CC. Mouth without barbels; 2 dorsal fins; adults with developed eyes; nasal tube a blind sac, not penetrating palate; gill openings, 7. *The Lampreys* (*Order Hyperoartii*), 5.

The True Fishes (*Class Pisces*).

AA. Mouth various, but always with articulated jaws, *i.e.* the floor of the mouth hinged; typically with 2 sets of paired fins.

The Sharks and Rays (*Subclass Elasmobranchii*)

D. Gill clefts multiple (5 to 7); skeleton largely cartilaginous; body covered with sand-paper-like denticles or naked; caudal fin (if present) margined above by the vertebral column (heterocercal); anus and urogenital apertures open externally by a common duct, the cloaca; skull without a system of membrane bones.

E. Gill openings 6; 1 dorsal fin; anal fin present; fish elongate. *The Natidanoid Sharks* (*Order Diplospondyli*), 9.

EE. Gill openings 5; 1 or 2 dorsal fins; anal fin present or absent.

F. Anal fin present; 2 dorsal fins, not preceded by a spine. *The Typical Sharks* (*Order Asterospondyli*), 10.

FF. Anal fin absent, dorsal fins if present with or without a preceding spine.

G. Gill openings lateral; 2 dorsal fins each preceded by a spine, form shark-like, not especially depressed in most forms. *The Cyclospondylus Sharks* (*Order Cyclospondyli*), 24.

GG. Gill opening ventral; dorsal fins small and posterior (on tail) or absent; body and pectoral fins forming a depressed disk, or if not as above with a long saw-like rostrum. *The Rays* (*Order Batoidei*), 26.

The Chimeras (*Subclass Holocephali*)

DD. Gill cleft single on each side; anus and urogenital apertures open separate externally.

H. Operculum a flap of skin; tail heterocercal; anal fin continuous with caudal; second dorsal separate; skin smooth or with prickles. *The Chimeras* (*Order Chimæroidei*), 40.

The Bony Fishes (*Subclass Teleostomi*)

HH. Operculum a thin bony plate; tail heterocercal or not; body usually covered with scales, sometimes naked or covered with hard plates or spines.

I. Tail heterocercal.

J. Skeleton largely cartilaginous; skin with hard bony plates interspersed with naked skin; mouth inferior, preceded by 4 barbels. *The Sturgeons* (*Order Chondrostii*), 41.

JJ. Skeleton bony; entirely covered with thick rhombic scales; mouth terminal, with no barbels. *The Gars* (*Order Rhomboganoidea*), 43.

II. Tail not heterocercal.

K. Gill openings in front of pectoral fins.

L. Dorsal and anal fins without spines (or sometimes with 1 or with a series of detached spines before dorsal fin); pectoral fins nearly or quite on the plane of the abdomen; ventral fins typically well behind pectorals.

M. Mouth with barbels or none; body scaled or naked; the gill openings restricted, the membranes attached to the isthmus.

N. Body not eel-shaped; ventral fins present; the gill openings a long slit; operculum evident.

O. Mouth with 4 pairs of long barbels; skin naked; an adipose fin present. *The Catfishes* (*Order Nematognathi*), 44.

OO. Mouth with a single pair of barbels or none; cycloid scales present; no adipose fin. *The Carp-like Fishes* (*Order Plectospondyli*), 46.

NN. Body eel-shaped; ventral fins absent, sometimes also pectorals; the gill openings small, more or less circular; operculum not evident. *The Eels* (*Order Apodes*), 49.

MM. No barbels about mouth (except sometimes when accompanied by exceedingly large pectorals, over half body length); scales usually present, although sometimes minute; the gill openings not restricted unless the body is armored with bony plates or with a long central caudal ray developed as a filament.

P. Scales not developed as a completely encasing bony armor.

Q. No spines in fins.

R. Pectorals not enlarged for flight or jaws not produced as a long beak, nor bearing a marked resemblance to the silversides.

S. Ventrals distinctly smaller than the pectorals, or if nearly of equal size an adipose fin present.

The Herring-like Fishes
(*Order Isospondyli*), 58.

SS. Ventrals larger than pectorals with an adipose fin present, or if absent, ventrals not quite equal to pectorals.

T. Ventrals larger than pectorals, an adipose fin present.

The Lantern Fishes
(*Order Iniomi*), 76.

TT. Ventrals not quite equal to pectorals; no adipose fin.

The Pike-like Fishes
(*Order Haplomi*), 79.

RR. Pectorals produced for flight or the lower or both jaws produced as a long beak, or resembling the silversides except in lacking a spinous dorsal fin.

The Synentognathous Fishes
(*Order Synentognathi*), 87.

QQ. Dorsal fin preceded by several sharp detached spines; ventrals with one large spine each unless the central caudal ray is produced into a long filament.

The Hemibranchs
(*Order Hemibranchii*), 97.

PP. Scales developed as a completely encasing armor.

The Pipe-fishes
(*Order Lophobranchii*), 101.

LL. Dorsal and anal fins typically with spines in their anterior parts; pectoral fins above the plane of the abdomen; ventral fins typically nearly under, under or in advance of pectorals.

The Spiny-rayed Fishes
(*Order Acanthopteri*), 105.

KK. Gill opening behind pectoral fin, which has an angulated base.

The Frog Fishes
(*Order Pediculati*), 300.

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FIELD BOOK OF MARINE FISHES OF THE ATLANTIC COAST

THE LANCELETS—*Class Leptocardii*

Small marine animals usually treated along with fishes, but whose zoological position is puzzling and still somewhat uncertain. The body is elongate and lanceolate in form, compressed, colorless and naked. There are dorsal, anal and caudal fins, more or less developed. The mouth is a longitudinal slit in an inferior position. There are no jaws and the oral slit is flanked by cirri. The gill slits are in a large number and open into the body cavity which is confluent with the respiratory cavity. The excurrent water escapes through a pore just anterior to the vent. The eyes are rudimentary.

THE LANCELETS—*Order Amphioxi*

This order contains the single family *Branchiostomidæ* to which it is consequently equivalent.

The Lancelets—*Family Branchiostomidæ*

The description under Class *Leptocardii* will suffice to differentiate these forms. They are found near sandy shores in warm seas throughout the world. They are all very similar in form and appearance and are chiefly distinguished by the numbers of muscular depressions along the sides.

Most of them burrow in the sand although some are reported to be pelagic.

A. Reproductive organs paired; anal fin with traces of fin rays; no caudal process.

B. Muscular bands behind vent 9 to 15; total number 61 to 64. *Amphioxus*, 4.

BB. Muscular bands behind vent 7 to 10; total number 57 to 61. *Florida Lancelet*, 4.

AA. Reproductive organs on right side only; anal fin without fin rays; a long caudal process about equal to head; muscular depressions about 66. *Bahama Lancelet*, 4.

Amphioxus *Branchiostoma virginiæ* Hubbs

Known from the Chesapeake Bay region.

Lives in the sand of shallow water and feeds chiefly on plankton which it strains from the water by means of its oral cirri.

The eggs are extruded and fertilized about sunset and develop so rapidly that they are already hatching by the dawn of the next morning.

Attains a length of about two and one-quarter inches.

Florida Lancelet *Branchiostoma floridæ* Hubbs

Known from Florida.

As in amphioxus there are about 22 to 26 pairs of gonads. The habits so far as known appear to be quite similar.

Reaches a length of about one and three-quarter inches.

Bahama Lancelet *Asymmetron lucayanum* Andrews

Known from Bimini and Nassau, Bahamas, probably also occurring on the Florida coast.

There are about 29 gonads, on the right side only.

In the evening during July and June they are frequently taken swimming actively at the surface (both larvæ and adults).

Reaches a length of about two and one-half inches.

THE LAMPREYS—*Class Marsipobranchii*

Elongate fish-like vertebrates which lack ribs, shoulder and pelvic girdles, paired fins and have no true jaws. The skeletons are cartilaginous and the skull is scarcely differentiated from the vertebral column. They are eel-like in appearance but are readily distinguished by their jawless sucking mouths.

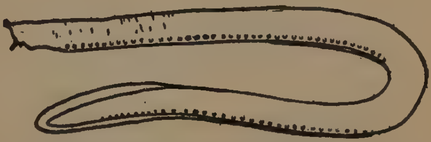
THE SLIME EELS—*Order Hyperotreti*

Represented in our region by a single family.

The Slime Eels—*Family Myxinidæ*

This family is readily distinguished from the only other one in the order by the possession of several barbels on the snout and a single gill opening on each side and a continuous dorsal fin.

Slime Eel
Myxine glutinosa
Linnæus



Known from the Arctic to Massachusetts and in deep water as far south as North Carolina. Also on the eastern side of the Atlantic.

The slime eel is so called from the tremendous amount of mucus that it emits when caught. It is reported that a normal slime eel of average size can easily fill a two-gallon bucket!

Being sightless and without any appendages of a locomotor nature, it apparently spends the daylight hours burrowed in a soft bottom and moves about by night in an eel-like manner, seeking its food by its olfactory sense. Fishermen of our northern latitudes are bothered by it as it habitually bores itself into the bodies of fishes held captive on set lines or in gill nets. For this reason it was formerly supposed to be parasitic in habit but its attacks on fishes are probably due to their being held fast on account of the intervention of man. Without such feasts unintentionally spread for it, its fare consists chiefly of dead or badly disabled fishes and it should be looked upon as a scavenger.

It is essentially a cold water inhabitant which accounts for its offshore and deep water dwelling to the southward of its range.

It has been held to be hermaphroditic, developing first as a male and later as a female, but this is a question. The eggs are large (about four-fifths of an inch) oval, tough shelled and few in number (about two dozen), each possessing a cluster of barbed filaments at either end. They are heavy and adhere in clusters to whatever they come in contact with. The young are essentially similar to the adults.

Reaches a length of a foot and a half.

THE LAMPREYS—*Order Hyperoartii*

Represented in our region by a single family.

The Lampreys—*Family Petromyzonidæ*

This family is distinguished from the preceding one by the possession of seven nearly circular gill openings on each side, a lack of barbels on the snout and by the dorsal fin being divided into an anterior and caudal portion.

Sea Lamprey

Petromyzon marinus Linnæus

Known on the north Atlantic coast south to Chesapeake Bay and rarely to Florida. Also on the European coast.

Unlike the slime eel, the lamprey is a vigorous swimmer and attacks fishes ravenously, eroding holes in their sides with its superior buccal rasping apparatus. It is not especially uncommon to find fishes with unmistakable scars as records of cases where they have been able to shake off their enemy. Cod, haddock and mackerel are amongst these species known to be attacked in this manner.

Lampreys are anadromous, entering streams in spring or early summer for the purpose of spawning. When a suitable gravelly bottom is encountered a nest is constructed by removing a sufficient quantity to make a large circular depression. This is done by attaching the suctoral mouth to a stone and actively swimming. This action aided by the current in the stream enables them to remove stones of a surprisingly large size. In their search for a suitable spawning bed the lampreys will overcome remarkable obstacles. Even dams of considerable size are scaled by inching up the damp sides by means of their sole implement—the large powerful sucking mouth. The eggs are heavy, minute and numerous, as high as 236,000 being deposited by a single female. They spawn but once, death following shortly after the act. The lower reaches of the streams frequented by them may be found thickly strewn with decomposing parents. The larvæ lack both eyes and teeth. Their time of entry into salt water is uncertain, although they may be found in the sea when not much over six inches long.

Formerly in the New England States, at least, they were taken in great numbers when ascending streams and salted, but today few people will eat them.

Adults reach a size of from 2 to 3 feet in length and may reach a little over 2 pounds in weight.

THE TRUE FISHES—*Class Pisces*

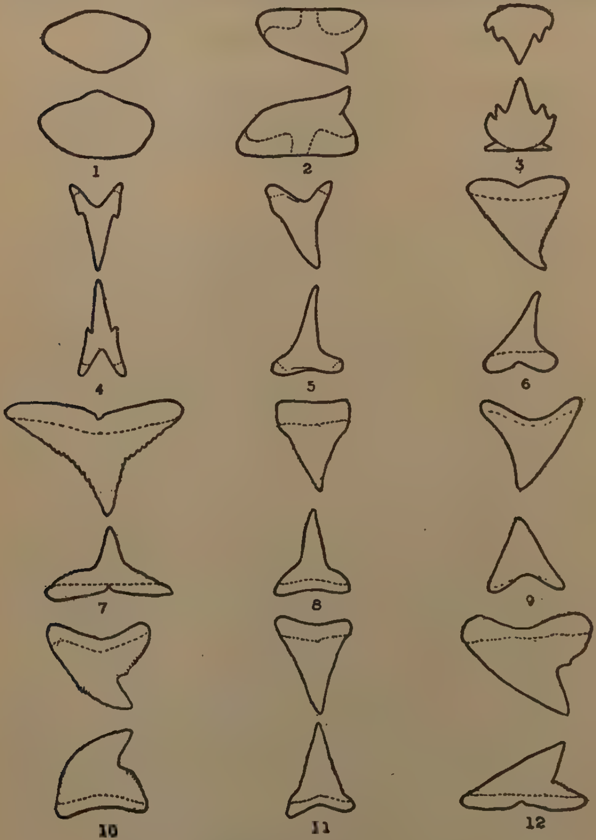
This group embraces the remainder of the vertebrates lower than amphibians. It is readily distinguished from the preceding groups by the possession of true articulated jaws. It includes in our region the sharks and shark-like fishes and the bony fishes.

THE SHARKS AND RAYS—*Subclass Elasmobranchii*

The sharks and rays are distinguished from the bony fishes by the fact that the skeleton is cartilaginous and although it may be calcified in parts it is never ossified. The simplest field character by which they may be distinguished is the possession of five or more slit-like gill openings on each side instead of a single one and the covering of the body which is usually beset with minute denticles that cover the fins as well. These denticles or placoid scales, somewhat suggest the scales of bony fishes but are not homologous with them. In the latter the dermis only is their seat of origin whereas in the case of the sharks both dermis and epidermis are involved. The teeth of sharks are essentially the same placoid scales, enlarged, modified and set in the gums. They are not embedded in the jawbones as in most bony fishes.

The rear portion of the digestive tract is modified into the so-called "spiral valve." This is formed by an interior spirally arranged fold of the membrane which increases its absorptive surface. A few of the more primitive bony fishes also possess this structure but it is typical of the Elasmobranchs.

Sharks may be distinguished from skates and rays for the most part by their less depressed form and large well-developed caudal fin in which the upper lobe is the larger. The vertebral column runs along its upper edge instead of stopping at the base of the fin as in most bony fishes. The gill openings are chiefly lateral in position. Our sharks are vivaparous so far as known. The young are essentially like the adults in form and are comparatively large at birth. Unlike most groups of fishes, the sex of an individual shark or ray is easily distinguished. The males have the inner edge of both ventrals



SHARK TEETH

An upper and lower tooth to the left of the symphasis. 1. Smooth dog shark; 2. Spined dogfish; 3. Nurse shark; 4. Sand shark; 5. Mackerel shark; 6. Blue shark; 7. Spot-fin ground shark; 8. New York ground shark; 9. Thresher shark; 10. Tiger shark; 11. Man-eater shark; 12. Hammerhead shark.

produced into elongate rod-like processes (the claspers). These function in the fertilization of the females in which the ventrals totally lack any such formation. For example the figure of the big skate represents a male and that of the starry skate a female. The skates are oviparous, depositing the familiar squarish egg cases and the rays are again vivaparous. Many sharks have a small opening behind each eye connected with the respiratory chamber. This is the spiracle and in the skates is large and prominent. Certain sharks have a nictitating membrane or secondary eyelid. Both of these characters figure in their identification. Page 8 represents the teeth of a dozen of the more characteristic types of sharks on our coast as these structures are of considerable significance in their differentiation.

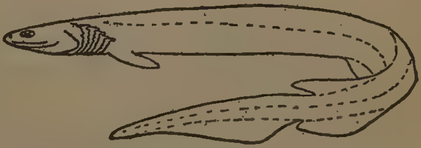
THE NATIDANOID SHARKS—*Order Diplospondyli*

This, a small group of sharks, is scarcely properly mentioned here as only one species even approaches our limits.

The Frilled Sharks—*Family Chlamydoselachidæ*

A family composed of a single deep water species which is readily recognized from any other species likely to occur in our waters. A related family (Hexanchidæ) is met with in Cuba occasionally in the form of the Cow Shark (*Hexanchus griseus* (Gmelin). This is a large form which might be looked for in Florida waters. It may be recognized by its 6 (instead of the usual 5) gill openings and from the present family by the fact that it is not eel-shaped, resembling more the conventional idea of a shark in form.

Frilled Shark
Chlamydoselachus anguineus
Garman



Known from deep waters of tropical and temperate seas. Probably cosmopolitan.

This rare and interesting shark is not recorded definitely from our coast, but should be watched for. It is included here on the strength of a questionable record from Pemaquid Point, Maine.

Like most deep water animals it is flaccid as compared with surface fishes.

The frilled shark is a very primitive type but nevertheless highly specialized along its own line.

Reaches a length of at least 5 feet.

THE TYPICAL SHARKS—*Order Asterospondyli*

This order contains most of the living sharks and those found in our waters are all of the suborder Galei which is characterized by having 2 dorsal fins, each without a spine, an anal fin and 5 lateral gill openings.

A. First dorsal over or behind ventrals; spiracle present; no nictitating membrane.

B. Nostrils not confluent with mouth; tail not bent abruptly upwards. *The Cat Sharks*, 11.

BB. Nostrils confluent with mouth; tail bent abruptly upwards and backwards from its base. *The Nurse Sharks*, 11.

AA. First dorsal somewhat in advance of ventrals.

C. First dorsal long and low, highest posteriorly; gill openings all in advance of pectoral; no pit at root of caudal; spiracle developed. *The False Cat Sharks*, 12.

CC. First dorsal high, highest anteriorly; its base entirely in front of ventrals.

D. Caudal fin not lunate, the upper lobe 2 or more times larger than lower, with a notch below near its tip; peduncle not keeled.

E. Last gill opening over base of pectoral. Spiracles small or absent; tail moderate or long.

F. Eyes with nictitating membranes; tail moderate, being less than one-third of total length.

G. Head normal, not expanded laterally. *The Requiem Sharks*, 12.

GG. Head expanded laterally (hammer or kidney-shaped). *The Hammer-head Sharks*, 18.

FF. Eyes without nictitating membranes; tail long, forming about one-half the total length. *The Thresher Sharks*, 20.

EE. Last gill opening in front of pectoral; spiracles pore-like; tail moderate. *The Sand Sharks*, 20.

DD. Caudal fin lunate; caudal peduncle with a keel on each side.

H. Last gill opening in front of pectoral; colors various but not covered with spots.

I. Gill openings moderate; teeth large and sharp; raptatorial. *The Mackerel Sharks*, 21.

II. Gill openings large, nearly meeting under throat; teeth very small. *The Basking Sharks*, 22.

HH. Last gill opening over pectoral; sides spotted with large light spots. *The Whale Sharks*, 23.

The Cat Sharks—*Family Scylliorhinidæ*

Deep water sharks, only one representative of which even approaches our limits. This species is readily recognized by its color pattern which consists of a network of black lines forming polygonal meshes on a light brown background.

Cat Shark *Catulus retifer* (Garman)

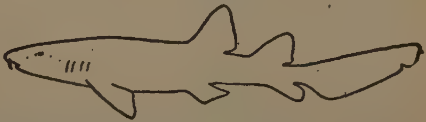
A Gulf Stream species of rather deep water. It is not known how frequently or how close it comes to shallow water or shore.

Probably does not exceed 2 feet in length.

The Nurse Sharks—*Family Ginglymostomidæ*

Rather large sharks of warm seas easily recognized by a pair of small barbels, one at either side of the mouth, the very small eyes, and, in our species, the brownish color.

Nurse Shark
Ginglymostoma cirratum
(Bonnaterre)



Known from Rhode Island to Brazil, but only as a rarity north of the Carolinas. Also on the west coast of Mexico.

The nurse shark is a sluggish and harmless shark of sandy tropical shores. It feeds on crabs, shrimp, squid, and in the New York Aquarium, at least, will take almost anything, amounting almost to a scavenger in habit.

In the waters about the Florida Keys the nurse shark comes into very shallow water for the purpose of mating.

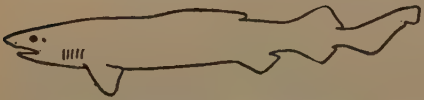
They seek such shallow water, over sandy beaches, that the dorsal fins are necessarily thrust high out of water. The local boys make sport by mounting them and holding on to the pectoral fins. Their unwilling steeds thus give them an exhilarating ride until deeper water forces them to relinquish their hold.

The large eggs are believed to be retained until hatched, the free young being released as in the requiem sharks. In this respect the nurse shark seems to represent an intermediate stage between those forms that give birth to living young and those that lay well protected and large eggs. The young, up to the size of about two feet, are sparsely covered with dark dots. These disappear later when the uniform tan color of the adult is assumed.

Reaches a length of from 6 to 10 feet.

The False Cat-sharks—*Family Pseudotriakidæ*

A family of a single very rare species which is at once recognizable by the unusual shape of the dorsal fin.



False Cat-shark

Pseudotriakis microdon Capello

Known only from two specimens, one from Portugal and the other from Amagansett, Long Island.

The latter was 10 feet long.

The Requiem Sharks—*Family Galeidæ*

A large family embracing the bulk of existing typical sharks. They are characterized by the following features: 2 dorsal fins, the first entirely before the ventrals, the second small and over the rather similar anal; the last gill opening above the pectoral, eyes with nictitating membranes; spiracles small or obsolete.

The numerous species are often very similar in appearance and difficult of determination.

The appearance of any large member of this family is looked upon with apprehension by bathers and others. Although it is undeniable that any large raptatorial shark if sufficiently hungry may present a potential danger to man, it is nevertheless extremely doubtful if a member of this family has ever actually attacked a human being in the water.

A. Teeth flat, blunt, and paved, without cusps or ridges; spiracles present; no pit at root of tail; labial folds well developed. *Smooth Dogfish*, 14.

AA. Teeth more or less compressed, with entire or serrate sharp edges.

B. Spiracles present, a conspicuous pit at root of tail; caudal fin with a double notch; teeth coarsely serrate, alike in both jaws, each with a deep notch on their outer margin. *Tiger Shark*, 15.

BB. Spiracles obsolete, lower teeth narrower than upper.

C. Angle of mouth without a groove or with only a slight depression which never extends along either jaw.

D. First dorsal nearer ventrals than pectorals; teeth strongly serrated; color deep blue. *Blue Shark*, 15.

DD. First dorsal nearer pectorals than ventrals.

E. Teeth all more or less serrate (sometimes entire in very young).

F. Teeth in both jaws distinctly serrate; the serræ on the lower teeth smaller; upper teeth decidedly broader than lower; snout not very acute, fins not tipped with dusky or black.

G. Upper teeth oblique, notched on outer margin; lower teeth narrow, scarcely notched.

H. Pectorals 3 times as long as broad, extending beyond base of first dorsal; nasal flap without a sharp lobe; color blue-gray. *Dusky Ground Shark*, 16.

HH. Pectorals not 3 times as long as broad, scarcely extending beyond base of first dorsal; nasal flap with an acute lobe; color yellowish brown. *Chub Shark*, 16.

GG. Upper teeth triangular, suberect, scarcely notched on outer margin, lower teeth similar but narrower.

I. Snout moderate, its length about equal to width of mouth.

J. Snout not especially blunt; second dorsal directly over anal and not noticeably smaller; length of front of dorsal a little less than half the distance from its base to snout. *New York Ground Shark*, 16.

JJ. Snout blunt, second dorsal distinctly in advance of anal and slightly smaller; length of front of dorsal equal to or a little more than half the distance from its base to snout. *Southern Ground Shark*, 17.

II. Snout very short, its length from mouth less than width of mouth; pectoral moderate, scarcely falcate, not nearly reaching end of dorsal base; preoral part of snout 1½ times in width of mouth. *Gulf Shark*, 17.

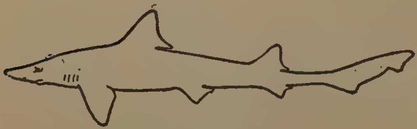
FF. Teeth similar in both jaws, slightly serrate, slightly constricted at base; snout rather acute, fins tipped with dusky or black. *Spot-fin Ground Shark*, 17.

EE. Teeth of lower jaw always entire, those of upper jaw serrate at base or entire.

K. Teeth of upper jaw serrate at base, erect; snout obtuse, its length from mouth ½ interorbital. *Yellow Shark*, 18.

KK. All teeth entire, nearly all erect. *Smooth-tooth Shark*, 18.

CC. Angle of mouth with a groove which extends for a short distance along either jaw, teeth entire or nearly so, oblique, their points turned away from the median line. *Sharp-nosed Shark*, 18.



Smooth Dogfish
Mustelus canis
(Mitchill)

Known from Cuba to Cape Cod and as a straggler to the Bay of Fundy. Also on the Atlantic coast of Europe.

A small harmless shark, somewhat of a bother to anglers seeking other fishes. It is an omnivorous feeder, somewhat scavenger in nature, with a decided predilection to crustacea. It hunts its food singly, although large numbers may be found in restricted localities of a favorable nature. The method of seeking food is interesting and has been studied in great detail. The olfactory sense is employed almost entirely. As the fish swims forward its head naturally sways from side to side. A morsel of food within its range of detection is almost sure to be sensed more strongly by one nostril than the other. The fish swerves to that side but passes beyond still in a curve so that the stimulation is now on the other side. Thus almost invariably a figure eight is described once or several times before the food object is located. Proof of this has been obtained by plugging one nostril with cotton. Then only circles are described and always in the one direction—towards the free nostril. Reversal of the plug will cause circling in the opposite direction. Of course it generally takes the fish longer to locate its food in this manner than with both nostrils functioning.

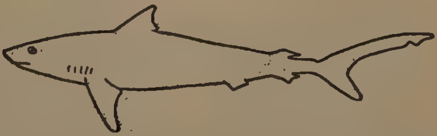
In the northern part of its range, at least, young are released in summer. They are usually 4 to 12 in number but have been known to reach as high as 27. They are usually a little over a foot long at birth.

Although despised by fishermen, it need not be, for the flesh is palatable and nutritious. Within very recent years there has been a growing realization of this and today in some markets it may be obtained in quantities.

Rare over 3 feet long, although known to reach nearly 5.

Tiger Shark

Galeocerdo arcticus Faber



LaMonte, PL. I

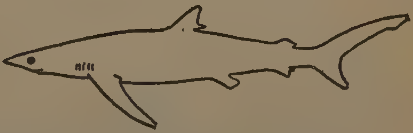
A large well known shark of tropical seas. Straggles northward on our coast occasionally as far as the Gulf of Maine.

An omnivorous feeder of active voracious habits. Among its known foods are fish, sea turtle and carrion.

This species is recorded as reaching as long as 30 feet but over 12 is uncommon. At this size they weigh in the neighborhood of 600 pounds.

Blue Shark

Prionace glauca (Linnæus)



A large shark of tropical seas rare on the American coast. Recorded as far north as Nova Scotia.

The color of this shark is most striking, being a deep sea blue not unlike that of the water of the Gulf Stream.

Reaches upward of 12 feet in length.

Dusky Ground Shark

Carcharhinus obscurus (Le Sueur)

Known from North Carolina to Maine (Portland) on our coast, but rare north of Cape Cod.

This form is often confused with the New York ground shark and consequently records of the two are not thoroughly reliable.

Feeds chiefly on fish, squid and crustacea.

Young, newly born, are sometimes taken in the latitude of New York in early fall.

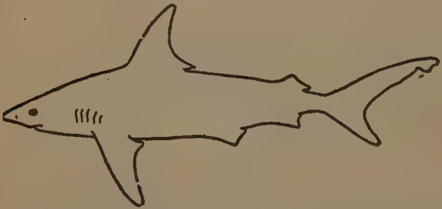
Reaches a length of 14 feet but rare over 10. At this size they weigh in the neighborhood of 600 pounds.

Chub Shark *Carcharhinus acronotus* (Poey)

West Indies, fairly common in Florida waters.

More yellowish brown in color than most of our other species of this genus.

Probably does not reach as large a size as most of the other "fish sharks."



New York Ground Shark

Carcharhinus milberti Müller & Henle

Due to confusion with the dusky ground shark its exact range is questionable, but apparently it reaches from Massachusetts to Virginia, becoming rare southward.

This shark feeds chiefly on bottom fishes such as the winter flounder and to a certain extent on crustaceans.

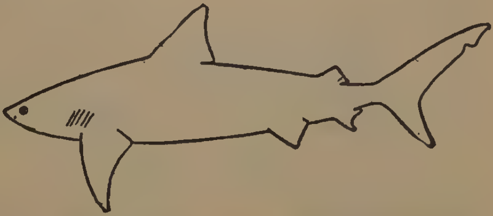
The number of young liberated by a female number from 6 to 13 and averages about 9. They are about 22 inches long and weigh about 2½ pounds at birth and are released in the latitude of New York from June to August. They are always born tail first.

There has been a gradual diminution in numbers of this as well as other species of the genus in New York waters.

This species reaches a length of about 8 feet and a weight of 200 pounds.

Southern Ground Shark

Carcharhinus commersonii (Blainville)



Known from warm Atlantic waters, reaching northward on our coast to Massachusetts.

A rather omnivorous feeder, slightly preferring fish and large crustacea.

The young average about 6 in number and are liberated in spring on the Florida coast.

Records exist of specimens up to 10 feet and a weight of 400 pounds, but those over 8 feet and 300 pounds are rare.

Gulf Shark *Carcharhinus platyodon* (Poey)

Abundant in the Gulf of Mexico, known from Cuba to Texas.

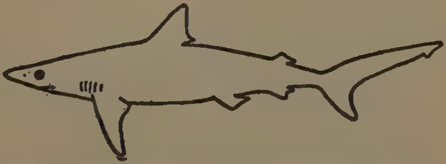
A large voracious species, feeding on all manner of refuse, fish, et cetera.

Possibly identical with the southern ground shark.

Reaches up to about 15 feet in length.

Spot-fin Ground Shark

Carcharhinus limbatus (Müller & Henle)



A shark of tropical waters, scarce on our coast north of Hatteras, but straggling to Massachusetts.

The young are usually from 3 to 6 in number and are a little less than 2 feet at birth, which takes place in spring in Florida waters. Adult males are generally absent from the same waters at this time.

Known to reach a length of 9 feet 2 inches and a weight of 300 pounds.

Yellow Shark *Hypoprion brevirostris* Poey

A West Indian species reaching northward to South Carolina. Rather common about the Florida Keys.

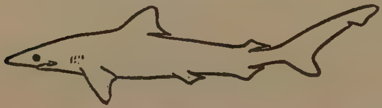
Like so many tropical sharks it frequents wharves in search of its food which is largely refuse but does not reach as large a size as many of the other species of similar habits.

Attains a length of about 7 feet.

Smooth-tooth Shark *Apriondon isodon* (Müller and Henle)

A rare species recorded variously from between New York and Cuba.

Little is known of its habits or the size it may reach.



Sharp-nosed Shark
Scoliodon terræ-novæ
(Richardson)

Known from Cape Cod to Brazil, but not common north of the Carolinas, reaching New Jersey only as a straggler.

A small species not known to reach over 3 feet in length.

Feeds largely on fish and crustacea.

The young are born during the spring and summer.

The Hammer-head Sharks—*Family Sphyrnidæ*

Easily recognized sharks with peculiar lateral expansions on the head from which they derive their name. The exact function of this curious modification has never been satisfactorily explained. It has been suggested that the expansions may act as a bow rudder. In some species the nasal groove runs for nearly the entire length of the anterior edge, presumably giving them a great olfactory advantage. At any rate, hammer-heads are usually the first, or at least among the first, to arrive at the scene of bloodshed.

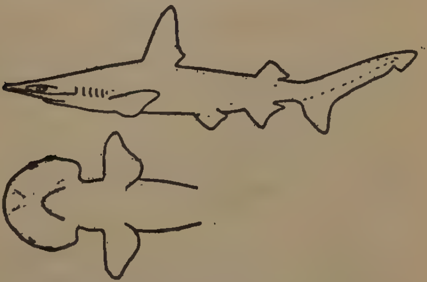
THE TYPICAL SHARKS

A. Nostrils near eyes; head kidney-shaped; groove of nostril obsolete. *Bonnet-head Shark*, 19.

AA. Nostrils with a well developed groove extending along front of hammer-shaped head. *Hammer-head Shark*, 19.

Bonnet-head Shark

Sphyrna tiburo (Linnæus)



Known on our coast north to Atlantic City, New Jersey, and rarely to Long Island.

A small species readily recognized.

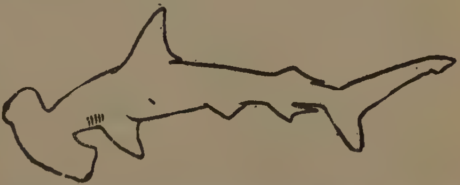
Feeds chiefly on fish and crustacea.

Gives birth to about 8 or 9 young at a litter.

Reaches a length of up to 5 feet.

Hammer-head Shark

Sphyrna zygæna (Linnæus)



LaMonte, pl. 3

A large curiously modified shark of warm seas reaching northward on our coast to the Gulf of Maine.

The extremely flat lateral expansion of the head bears the eyes on their outer edges and the nostrils are elongated into slits running along nearly the entire front edge of the "hammer." They are active and fast moving sharks and possibly the expansive area of the head acts as a bow rudder, increasing dexterity as well as forming a wide-set mounting for the sensory organs, as has been suggested.

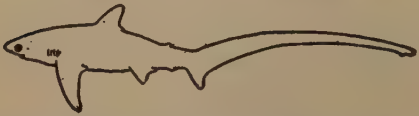
Feeds largely on fish and squid. Fragments of sting rays have been found in their stomachs.

The broods of this shark are large, as high as 37 embryos being taken from one female. In the latitude of New York very young examples of about 2 feet are common in summer.

Although reaching a length of 17 feet, examples of over 12 are not common. Reaches a weight of about 1500 pounds.

The Thresher Sharks—*Family Alopiidæ*

A family of one species immediately recognizable because of its excessively long and attenuate tail.



Thresher Shark

Alopias vulpes
(Gmelin)

LaMonte, PL. 1

Known from all temperate seas. North on our coast to Block Island and rarely to the Gulf of St. Lawrence.

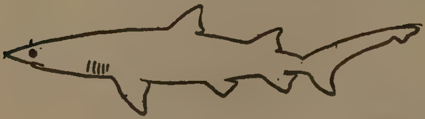
The extreme elongation of the tail of this species has led to considerable speculation concerning its possible function and many fantastic stories have been spread of it beating porpoises to death. These are entirely without sound basis. There is, further, a confusion of the name "Thresher" as it is sometimes used to mean the killer whale.

It feeds on fishes such as mackerel, menhaden, and herring. They are reported to circle small groups of such fishes schooling them into compact groups for ready attack. It seems to be uncertain whether the flail-like tail is used to maim the fish or not, but at least it would naturally aid in massing them.

Reaches about 20 feet, but examples over 15 are rare. An example of 13 feet weighed about 400 pounds.

The Sand Sharks—*Family Carchariidæ*

Typically Atlantic sharks represented on our coast by one species readily recognized by the combination of characters given in the key and by their warm brown color which is sometimes somewhat blotched, especially in the young.



Sand Shark

Carcharias littoralis
(Mitchill)

Common from Cape Cod to Hatteras. Stragglers north to Maine. It is doubtful if this species is distinct from the European *C. taurus* Rafinesque.

Feeds chiefly on small fishes and to a lesser extent on squid and crustacea.

Recorded as reaching nearly 9 feet and weighing about 250 pounds. Examples of over 5 feet are rare, however.

The Mackerel Sharks—*Family Lamnidæ*

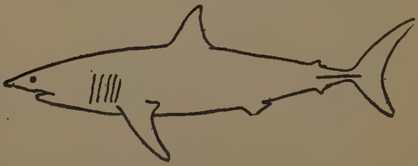
Large oceanic sharks marked by their nearly symmetrical tails, lateral keels on the peduncle and the characters given in the key. They are the fastest of the sharks as their form and tail structure indicates. As is frequent with other and unrelated fishes (*e.g.* mackerels) possessing a narrow peduncle, correlated with fast swimming, it has here been quite independently strengthened with lateral keels.

A. Teeth slender and sharp with entire edges.

B. Origin of first dorsal over axil or posterior part of pectoral; origin of second dorsal over origin of anal or only slightly in advance of it; at least some teeth with basal denticles; lower caudal lobe 0.70 of upper. *Mackerel Shark*, 21.

BB. Origin of first dorsal posterior to pectoral; origin of second dorsal notably anterior to anal; no basal denticles on teeth; lower caudal lobe 0.75 of upper. *Sharp-nosed Mackerel Shark*, 22.

AA. Teeth triangular with serrate edges. *Man-eater Shark*, 22.



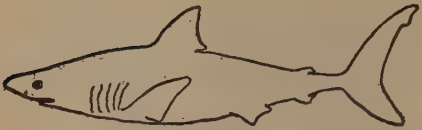
Porbeagle
Mackerel Shark
Isurus nasus
(Bonnaterre)
La Monte, PL. 2

Known from both Atlantic and Pacific Oceans.

The mackerel shark feeds mostly on small fish, such as mackerel, herring, et cetera.

These sharks are primarily surface sharks and spend much of their time basking with their dorsals protruding from the surface, generally well offshore.

Reaches a length of 12 feet, but rarely over 8 or 9.



Sharp-nosed Mackerel Shark

Isurus tigris (Atwood)

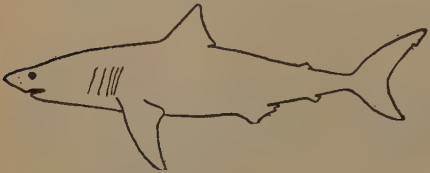
LaMonte, PL. 2

A large oceanic species straggling north to Maine.

This is an exceedingly swift shark and named for the tail which is superficially not unlike that of the mackerel and other rapid swimmers.

Its feeding habits are probably very similar to those of the common mackerel shark.

Reaches a length of over 10 feet.



Man-eater Shark

Carcharodon carcharias (Linnæus)

LaMonte, PL. 3

A comparatively rare form of tropical and sub-tropical seas on occasion straggling northward on our coast to Nova Scotia.

This shark is one of the largest and most powerful of existing fishes. Those of the largest size are lead white in color, but the smaller ones are dark below. There is no doubt that this species is dangerous to bathers and it is fortunate that it is not common at any one place.

The few definite and authentic records of sharks attacking man all refer to this single species.

Feeds on large fishes and sea turtles. A record from the Pacific mentions a whole fair-sized young sea lion in one of 30 feet.

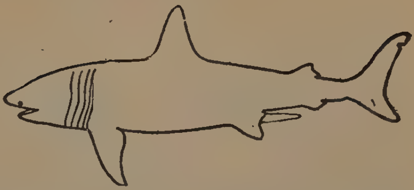
Reaches a length of 40 feet or more.

The Basking Sharks—*Family Cetorhinidæ*

Sharks of immense size readily recognized, in part by their size and very small teeth. They lack the pattern characteristic of the whale shark, the only other fish they might be confused with.

Basking Shark

Cetorhinus maximus
(Gunner)



An exceedingly huge fish of circumpolar distribution. Formerly common off Massachusetts and casual as far south as Virginia. Now rare, possibly being reduced by the former oil fishery activity.

This species is sluggish and although generally solitary is sometimes seen in schools.

Like many large oceanic animals, its food consists of exceedingly small organisms which it sifts from the sea, by a special straining apparatus functionally not unlike that possessed by the whalebone whales.

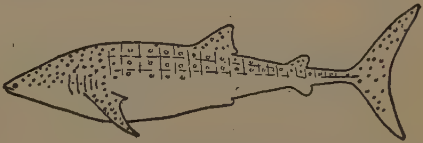
Reaches a length of at least 45 feet.

The Whale Sharks—*Family Rhineodontidæ*

Immense sharks of a single species characterized by their small teeth and their pattern of light spots combined usually with crossing lines, more or less in checker board fashion.

Whale Shark

Rhineodon typus
Smith



Variously reported from the Mediterranean, the West Indies, the Cape of Good Hope, and the Pacific.

Several interesting records have been recently made, one from the Florida Keys. Very little is known of their habits, food, or other characteristics. They appear to be solitary in habit.

Teeth in a 23-foot specimen were only 2 mm. long. Supposedly feeds on small plankton organisms. This immense shark is apparently without any defensive or offensive equipment.

Reaches at least 38 feet in length and a weight of 26,594 pounds.

The Cyclospondylous Sharks—*Order Cyclospondyli*

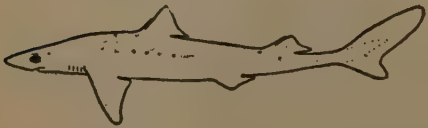
Sharks that are recognizable by the possession of 2 dorsal fins which may or may not be preceded by a spine, spiracles, and no anal fin.

A. Form shark-like, not depressed.
B. Dorsal fins each preceded by a stout spine, the first dorsal far in advance of ventrals. *The Dogfishes*, 24.
BB. Dorsal fins without spines; the first dorsal over or in advance of ventrals.
C. First dorsal much before ventrals, skin only moderately rough. *The Scymnoid Sharks*, 25.
CC. First dorsal over ventrals; skin with thorn-like tubercles. *The Bramble Sharks*, 26.
AA. Form depressed, skate-like but with a constricted "neck" in which the gill openings lie. *The Angel Sharks*, 26.

The Dogfishes—*Family Squalidæ*

Small sharks readily located by the key characters; chiefly the possession of a single spine at the front of each dorsal.

A. Upper teeth simple, without smaller cusps at base.
B. Teeth alike in both jaws, sub-quadrate, each with a nearly horizontal cutting edge and a point directed outward, dorsal spines exposed. *Spined Dogfish*, 24.
BB. Teeth unequal, the upper very small, narrow, lanceolate and erect, the lower more or less oblique; dorsal spines hidden in skin. *Portuguese Shark*, 25.
AA. Upper teeth each with 1 or 2 cusps on each side, very small and pointed. *Black Dogfish*, 25.



Spined Dogfish
Squalus acanthias
Linnæus

Known on both sides of the Atlantic, on our coast south to Cuba, but not common south of Virginia.

A cold water species confined to our deeper waters in the warmer months. Travels in schools of great size. They also disappear during the very coldest months, when their whereabouts is not known.

Feeds chiefly on fishes, squid and worms, and in common with few other fishes crams itself with jellyfish when these are available.

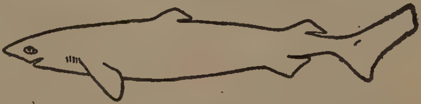
On our coast, at least, the spined dogfish appears to give birth to from 1 to 11 young in late winter or early spring.

Like many sharks this species is palatable if properly prepared. During the world war it was canned extensively under the name of "gray fish," but this industry has since fallen off.

Reaches a length of 3½ feet and rarely 15 pounds.

Portuguese Shark

Centroscymnus cœlolepis Bocage & Capello

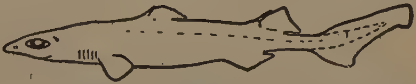


Known from off New England in deep water. Rare, but probably strays at times to within the 25 fathom limit.

Reaches a length of 4 feet.

Black Dogfish

Centroscyllium fabricii (Reinhardt)



Known only from deep water. Probably cosmopolitan, but may stray into shallow water rarely.

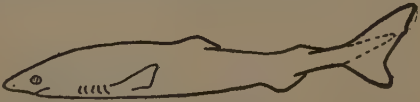
Reaches a length of 3½ feet.

The Scymnoid Sharks—*Family Dalatiidæ*

Sharks with no anal fin and 2 spineless dorsals.

Greenland Shark

Somniosus microcephalus (Bloch & Schneider)



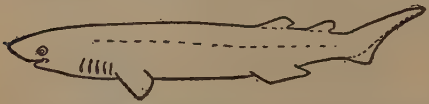
Known from the Arctic seas to Cape Cod.

An exceedingly sluggish fish of great size but apparently quite harmless to men, although nevertheless rapacious, feeding on practically anything of an animal nature. It spends most of its time near the bottom.

Reaches a length of 24 feet, but specimens over 18 feet are rare.

The Bramble Sharks—*Family Echinorhinidæ*

A family composed of a single deep water species whose characters are given in the key.



Bramble Shark

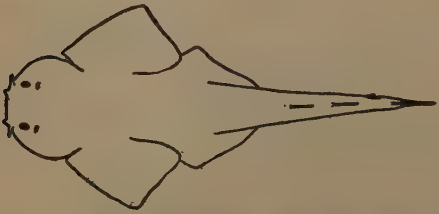
Echinorhinius brucus Bonnaterre

Known chiefly from the European coast, one record from Provincetown, Maine, the only west coast record. Probably normally lives at relatively great depths of more than 200 fathoms.

Reaches a length of 10 feet.

The Angel Sharks—*Family Squatinidæ*

Curious skate-like sharks, depressed, and intermediate between the sharks and rays in form.



Monkfish

Squatina squatina (Linnæus)

A depressed shark-like fish occurring in warm seas and reaching rarely on our coast as far north as Cape Cod.

Reaches a length of about 3 feet.

THE RAYS—*Order Batoidei*

Much depressed shark-like fishes in which the gill openings are inferior and five in number. There is no anal fin and the dorsals if present are inserted on the tail. There is a spiracle connected with the gill chamber and opening dorsally. They vary from forms like the saw fish which is superficially shark-like to the extremely depressed and flattened rays.

A. Tail comparatively thick with 2 dorsals and a caudal fin, no serrated caudal spine.

B. Snout flat, produced into a long armed rostrum with strong teeth set on either side, form somewhat shark-like. *The Sawfishes*, 27.

BB. Snout not saw-like, the body much depressed.

C. No electric organs; skin not perfectly smooth.

D. Snout long; width of body about ⅓ of length, gradually passing into tail. *The Guitar Fishes*, 28.

DD. Snout shorter; body about as wide as long, abruptly terminating behind. *The Skates*, 28.

CC. Electric organs present (a structure of hexagonal tubes between pectoral fins and head); skin perfectly smooth. *The Torpedoes*, 32.

AA. Tail comparatively slender, often whip-like; dorsal fin single or absent; the back of tail usually with 1 or 2 serrated spines.

E. Pectoral fins not interrupted, confluent around snout; teeth small. *The Sting Rays*, 33.

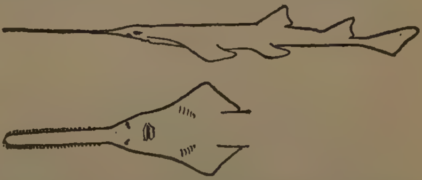
EE. Pectoral fins interrupted, one portion forming detached appendages on the snout.

F. Teeth large, flat, tessellated, cephalic appendages not conspicuous. *The Eagle Rays*, 37.

FF. Teeth small, tubercular; cephalic fins conspicuous, resembling horns. *The Mantas*, 39.

The Saw-fishes—*Family Pristidæ*

Shark-like rays with a large tooth-bearing rostral process that resembles a double-edged saw. Found in warm seas. The eggs hatch within the body of the female and at that time the short saws of the young fish are covered with a smooth fleshy sheath which they lose soon after birth.



Saw-fish

Pristis pectinatus
Latham

LaMonte, PL. 4

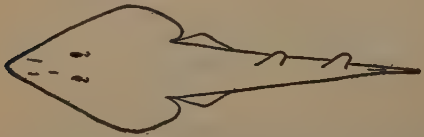
Common in the Gulf of Mexico and Florida waters. Sometimes ascends rivers for considerable distances. Known as a straggler as far north as New Jersey. Reaches a length of 18 feet, 11¾ inches. Although not generally used, small sawfish of 3 feet or so are delicious as a breakfast pan fish. The caudal part if stripped of its tough skin and cut into miniature "steaks" might please an epicure.

The young are released in spring and summer and their "saws" at that time are covered with a protecting sheath which renders them harmless to the mother fish.

Another species, *Pristis perrotteti* Valenciennes, should be watched for in our southern states. It has only 18 to 20 pairs of teeth on its "saw", the first dorsal is somewhat in advance of the ventrals and the caudal has a small lower lobe whereas our common sawfish, *P. pectinatus* has from 24 to 32 pairs of rostral teeth, the first dorsal is opposite the ventrals and there is no lower caudal lobe.

The Guitar Fishes—*Family Rhinobatidæ*

Shark-like skates, more depressed than sawfishes but not as broad and flat as the subsequent forms. Inhabit warm seas and are ovoviviparous, giving birth to active young as do the sawfishes.



Guitar Fish

Rhinobatus lentiginosus Garman

Fairly common about Florida and recorded as a straggler as far north as North Carolina. Grayish in color, closely spotted with pale dots above, uniform below. The width is contained about three times in the length of the body and the tail about two. There are other species to the south of our range which are readily distinguished on account of being covered with large light blotches instead of small dots.

Reaches a length of about 2 feet.

The Skates—*Family Rajidæ*

Well depressed rays, exclusively fishes of smooth and generally sandy bottoms. The skin is more or less covered with spines, prickles and similar armature. The tail is muscular and has a longitudinal fold on each side and usually two dorsal fins and sometimes a caudal fin. Skates are oviparous, the eggs being familiar objects of the seashore. They are dark brown or blackish capsules of considerable size, quadrate in outline and have a horn-like tentacle projecting parallel with the long side from each corner. Found in cool seas, but not in the tropics except in very deep water.

A. Midline of back and tail behind shoulders; unarmed (except in young); outline of disc before spiracles obtuse, without acute angle at tip of snout; species with round dark spots.

B. Teeth in 50 series in each jaw; no pectoral ocellus. *Common Skate*, 29.

BB. Teeth in about 90 series in each jaw, usually a pectoral ocellus. *Big Skate*, 30.

AA. Mid-line of back with a row of spines, (all ages).

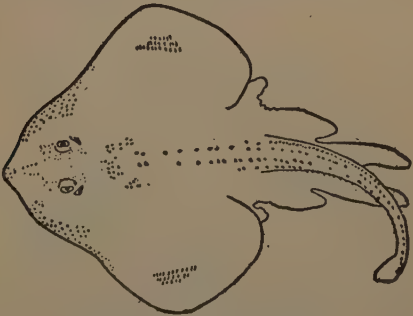
C. Angle at tip of snout short, obtuse teeth in 30 to 50 series; body and tail with large stellate bony bucklers. *Starry Skate*, 30.

CC. Angle at tip of snout acute, moderately long, no large bony bucklers.

D. Spines on skin above scarcely stellate, teeth in 50 rows, color brown with darker markings. *Clearnosed Skate*, 31.

DD. Spines on skin above, small; their bases stellate; teeth in 40 rows; color brown; sometimes with 1 or 2 paler spots above. *Briar Skate*, 31.

CCC. Angle at tip of snout much produced, blunt at tip, teeth in 30 rows, skin nearly smooth, spines few and small, color brownish with paler spots. *Barn-door Skate*, 32.



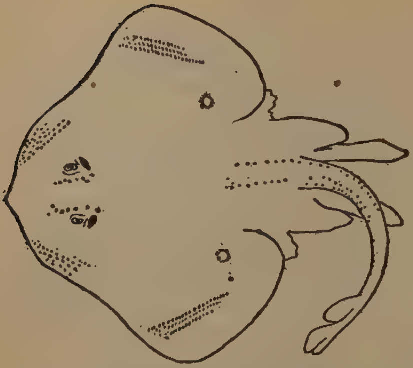
Common Skate

Raja erinacea
Mitchill

Known from the Carolinas to Halifax. Common in shallow water on sandy bottoms off New England and New York.

The eggs are laid in summer and measure about 2 by 2½ inches. As with most of these very depressed and bottom-inhabiting forms the food consists largely of small crustacea, mollusks, etc.

Reaches a length of not over 2 feet.

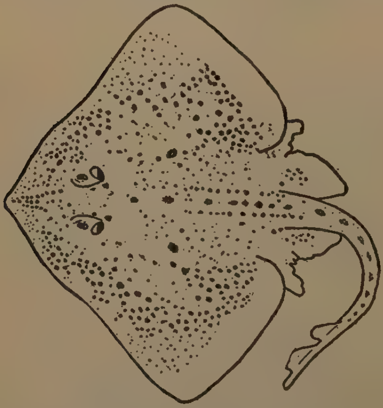


Big Skate

Raja diaphanes
Mitchill

Occurs from Virginia to the Gulf of St. Lawrence, there becoming quite common. In the latitude of New York they are not common in water of less than five fathoms in summer but in early spring and late fall may be found in our more shallow inlets. Apparently the eggs are released in winter and are about 2½ by 1¾ inches.

Attains a length of about 3 feet.



Starry Skate

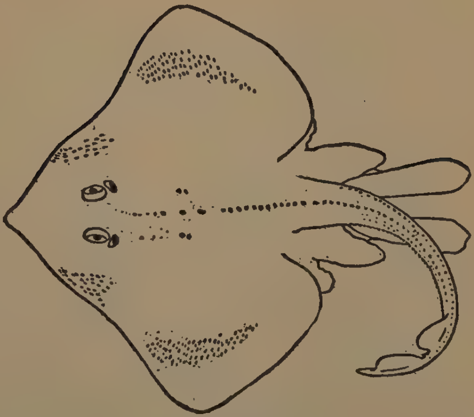
Raja scabrata
Garman

Not known south of Massachusetts nor north of the Straits of Belle Isle. Represented by a related form on the northern coast of Europe which may be the same.

Reaches a length of about 2½ feet.

Clear-nosed Skate

Raja eglanteria Lacépède



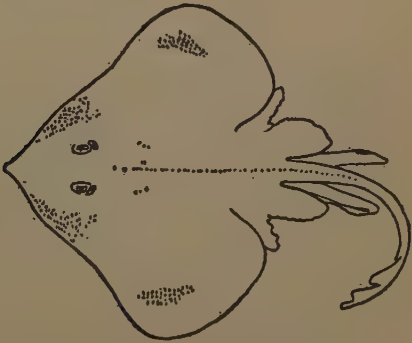
Known from Florida to the Gulf of Maine, but not common south of Delaware or north of Massachusetts. About New York waters most common in the summer, though less numerous in the hottest months when it probably moves further north or goes into deeper water. The common name is derived from two exceptionally translucent quadrangular areas on either side of the snout.

Feeds chiefly on crustacea and fish.

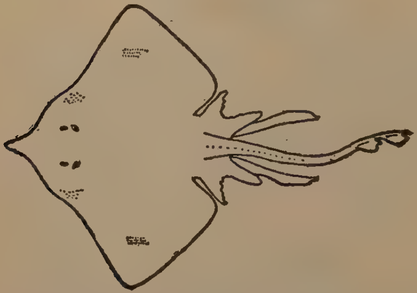
Reaches about 2 feet in length.

Briar Skate

Raja senta Garman



A rare species. Found usually in deep water. Known from Newfoundland to Cape Cod. Similar in appearance to the common skate, but the snout is pointed; more like that of the clear-nosed skate.



Barn-door Skate
Raja stabuliforis
Garman

Known from Florida to Nova Scotia, tending to keep in deep water. The egg cases of this species seem not to be cast up as often on the shores of the northern part of its range as they are in the southern. They measure about 5¼ by 2¾ inches. The large "wings" of all our skates make excellent food but popular aversion keeps their meat from finding a ready sale.

Reaches a length of over 6 feet, our largest skate.

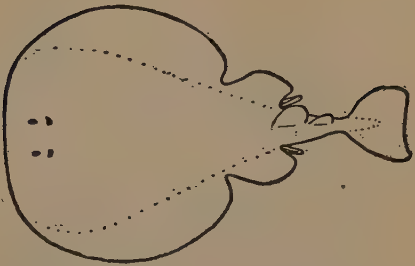
The Torpedoes—*Family Torpedinidæ*

Depressed rays with completely unarmored skin. Tail relatively short and thick, terminated by a small-sized caudal fin. Two dorsal fins inserted after ventrals. A longitudinal fold of skin on either side of tail. A large electric organ between the head and pectoral fins capable of being discharged with some violence. Typical of most warm seas. Like the sting rays these fishes give birth to live young.

A. Spiracles not nearly in contact with eyes, with entire edges, not roughened, nearly uniformly black, rarely spotted. *Torpedo*, 33.

AA. Spiracles close behind eyes, edges roughened; variously mottled with light or dark. *Electric Ray*, 33.

Torpedo
Narcacion nobiliana
Bonaparte



Known from Maine to Cuba, also on the coast of Europe. Not very common any place. Taken about New York in fall and during the summer and fall in Massachusetts. Rare north of Cape Cod. Feeds chiefly on fish.

Its entire defense mechanism is centered in its ability to give true electric shocks of a rather severe nature.

Reaches a weight of 200 pounds, although a weight of over 30 is not common. A specimen of 5 feet may weigh 75 pounds.

Electric Ray *Narcine brasiliensis* (Olfers)

Known principally south of our range but not uncommon on the West coast of Florida and has been taken as far north as North Carolina. The electric powers are somewhat less in this form.

Does not reach as large a size as the preceding species, seldom attaining a length of 2 feet.

The Sting Rays—*Family Dasyatidæ*

Skate-like fishes which may have one or no dorsal fins and in which the tail is usually long and whip-like and generally provided at its base with a sharp and dangerous serrated spine.

The sting rays give birth to live young.

A. Tail stout, provided with a rayed caudal fin; no dorsal; disk roundish; caudal spine strong. *Round Sting Ray*, 34.

AA. Tail slender, no caudal fin.

B. Tail long, whip-like, much larger than disc; caudal spine strong.

C. Tail with a keel or wing-like expansion below only; tail with rough tubercles, more than twice length of disk; disk broader than long, its length 1¼ its width. *Northern Sting Ray*, 34.

CC. Tail with a narrow keel or expansion both above and below, its length less than twice length of disk.

D. Tail with a simple keel above and a wing-like expansion below; shoulder with 3 series of tubercles; width of disk about 1.2 in its length; middle of forehead with a small, round light colored spot. *Southern Sting Ray*, 35.

DD. Tail somewhat compressed; with a wing-like expansion above and a larger one below.

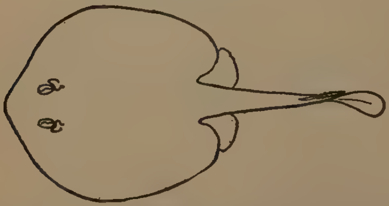
E. Skin more or less prickly in adult with a series of tubercles on back; wing-like expansion below tail the longer; angle of snout about 90°. *Stingaree*, 35.

EE. Skin nearly or quite smooth in adult, median line of back with not more than one spine; wing-like expansions on tail about equal in height; angle of snout about 120°. *Say's Sting Ray*, 35.

BB. Tail short, much shorter than disk; caudal spine weak or absent, no dorsal fin.

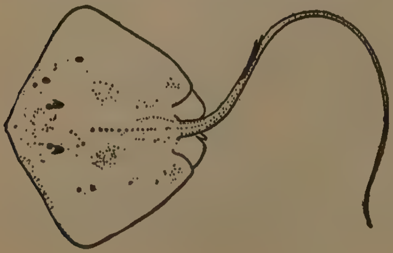
F. No spines at base of tail; no tentacles behind spiracles. *Butterfly Ray*, 36.

FF. One or more small spines at base of tail; a tentacle behind spiracle. *Giant Butterfly Ray*, 37.



Round Sting Ray
Urobatis sloani
(Blainville)

Common throughout the West Indies and our southern shores. Brown, sprinkled with yellow spots, edged with darker. Everywhere sparsely covered with small prickles. Generally not reaching much over a foot in length.



Northern Sting Ray
Dasyatis centrura
(Mitchill)

Known from Maine to Cape Hatteras, common in the southern part of its range.

Feeds mostly on mollusks, crabs, annelids, et cetera.

Reaches a length of 12 feet although over 6 is uncommon.

Southern Sting Ray

Dasyatis americana Hildebrand & Schroeder

This form replaces the northern sting ray south of Cape Hatteras. Its habits are very similar to those of the northern sting ray.

Stingaree *Dasyatis sabina* (Le Sueur)

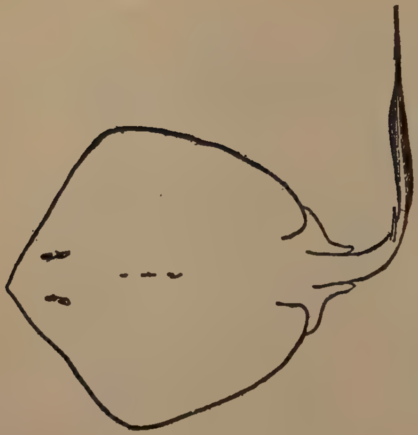
Known from Brazil to Chesapeake Bay. It tends to run into estuaries and streams extending even up into fresh water.

Little is known of this ray although apparently it is not uncommon in Chesapeake Bay.

Say's Sting Ray *Dasyatis say* (Le Sueur)

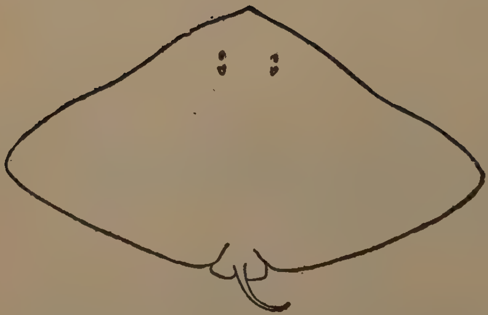
From Carolina, southward, common in Florida, and sometimes straying northward to New York. Color of adult olive brown, young reddish or yellowish.

It is supposed to migrate southward in fall in the northern part of its range.



Say's Sting Ray

Dasyatis say
(Le Sueur)



Butterfly Ray

Pteroplatea micrura
(Schneider)

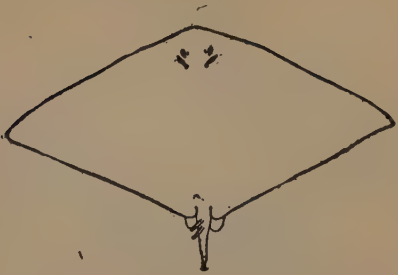
Common on the Carolina coast reaching as far north as Cape Cod and south to Brazil. Like most fishes of this type it feeds chiefly on the bottom on crustaceans, et cetera.

The usual number of young to a litter is two.

Reaches a width of over 2 feet.

Giant Butterfly Ray

Pteroplatea altavela (Linnæus)



Rare on our coast, once reaching Massachusetts, but extends to Brazil and the Mediterranean Sea.

The butterfly rays are so named from their manner of swimming, which is effected by a flapping of the lateral expansions which on account of their shape somewhat resembles the flight of a butterfly.

Reaches a width of over 5 feet.

The Eagle Rays—*Family Aëtobatidæ*

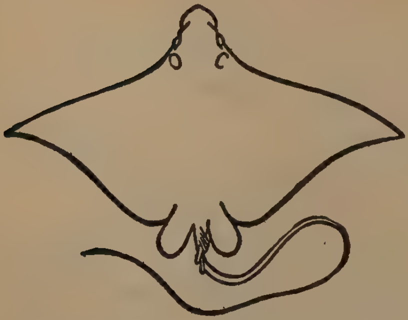
Well depressed rays in which the broad pectorals are not continued to the end of the snout but ceasing on the sides of the head and appearing again in front of the snout as one or two fleshy protuberances (cephalic fins); tail long and whip-like with a single dorsal fin near its root. Head less depressed than in other families. Like the preceding family these fishes give birth to living young.

A. Teeth in a single series, very broad; muzzle entire; disk twice as long as broad, covered with small spots. *Spotted Whip Ray*, 38.

AA. Teeth in several series, the middle series very broad.

B. Muzzle entire; teeth in main row 4 to 6 times as broad as long; disk not quite so long as broad. *Eagle Ray*, 38.

BB. Muzzle emarginate; cephalic fins below level of disk; disk about ⅓ broader than long. *Cow-nosed Ray*, 39.



Spotted Whip Ray

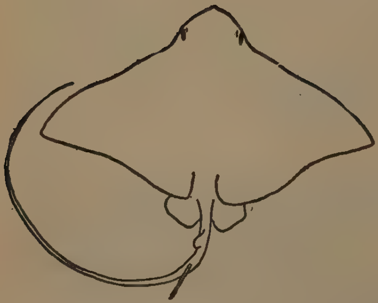
Aëtobatus narinari
(Euphrasen)

Tropical seas north to Virginia, but not very common in our waters.

Feeds on hard shelled mollusks to a large extent.

About 4 young are reported to be released at a time and near the surface of the water.

Reaches 12 feet in length and a weight of 450 pounds.



Eagle Ray

Myliobatus freminvillei
(Le Sueur)

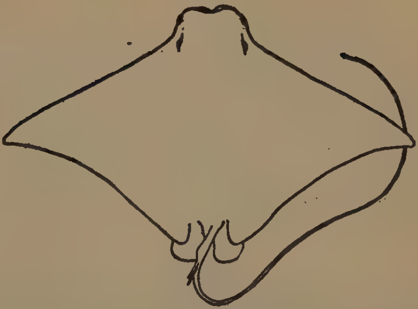
Reaching, on our snores, north to Cape Cod. Fairly common in the southern part of our range.

Feeds on lobsters, crabs and large mollusks.

Reaches up to 5 feet in width.

Cow-nosed Ray

Rhinoptera quadriloba
(Le Sueur)



Known from Nantucket to Florida. The commonest of our eagle rays.

The cow-nosed ray feeds largely on mollusks and is especially destructive to soft clams. Generally light tan in color.

It reaches not over 7 feet in width, although, most, in the northern part of its range, are much smaller.

The Mantas—*Family Mobulidæ*

Extremely large rays similar to the eagle rays but with the cephalic fins developed as two long ear-like appendages.

A. Teeth in both jaws; mouth inferior. *Little Devil Fish*, 39.
AA. Teeth in lower jaw only; mouth terminal. *Great Manta*, 39.

Little Devil Fish *Mobula olfersi* (Müller & Henle)

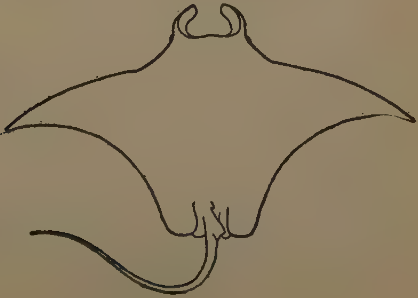
West Indian, north to North Carolina. Recorded from New York. Not common.

Does not reach a really large size, as these fishes go.

Great Manta

Manta birostris
(Walbaum)

La Monte, Pl. 4



Reaches as far north as Rhode Island on occasion. Fairly common in the tropics.

Harpooning these rays is possible as they spend considerable time near the water's surface, but it is considered a somewhat dangerous sport on account of their great size and power.

The skin is covered with tiny rough tubercles. Brownish in color with the margins of the disk darker.

One of the largest of fishes, reaching a width of 22 feet and a weight of over 3,000 pounds.

THE CHIMERAS—*Subclass Holocephali*

This peculiar group of fishes is most closely related to the sharks but differs in numerous vital characters.

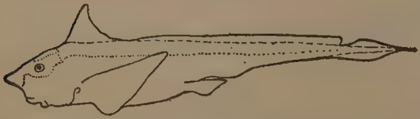
There is but one gill-opening on a side, the tail is symmetrical and the gills resemble those of the bony fishes.

THE CHIMERAS—*Order Chimæroidei*

This single order is covered in the above description.

The Chimeras—*Family Chimæridæ*

The above definition covers those of the family.



Chimæra
Chimæra affinis
Capello

Known on our coast from Cape Cod northward, but not likely to occur, except by accident, in less than 300 fathoms.

There is slight chance of confusing this weird looking fish with any other form or of finding one within the limits of our range.

Nothing is known of the habits of this species, but it is probably omnivorous and with little doubt produces heavy oval egg cases as do related forms.

Reaches a length of about 3 feet.

THE BONY FISHES—*Subclass Teleostomi*

The more primitive members of this great aggregation of fishes resemble the sharks in certain respects such as the possession of a heterocercal tail (with the vertebral column margining the tail above). It is rather difficult to frame a short simple definition of this variable and extensive group that would be of value to the amateur ichthyologist. However, it may be mentioned that most of the members have fins supported by stiff or flexible rods between which stretch membranes which are often transparent. These fins are usually capable of erection or depression. This is not so in the case of the sturgeon, superficially our most shark-like member of this group. In combination with fins of this type are usually to be found thin imbricated scales, but some forms have lost them entirely or have them thickened and even solidified into a solid encasement. Usually also the gill opening is covered with a bony operculum more or less evident.

The characters given in the ordinal key "Skull with a system of membrane bones (operculum, etc.), a single gill opening" with the characters of the various orders within it that occur in the region treated may suffice for present purposes.

THE STURGEONS—*Order Chondrostei*

An order of only one family, the sturgeons, described below.

The Sturgeons—*Family Acipenseridæ*

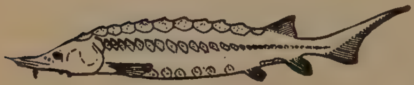
Large fishes with a rather pointed overhanging snout, the mouth being well underneath. The body is armed with five series of bony keeled shields and the skin between is usually covered with minute plates. The tail fin is prominently unsymmetrical with the vertebræ margining the border above as in the sharks.

A. Space between dorsal and lateral shields with stellate plates of rather large size, in 5 to 10 series; last dorsal shield of moderate size, more than ½ length of the one before it; dorsal 38, anal 27; dorsal shields about 10; lateral 29, ventral 9, snout nearly 2 in head. *Common Sturgeon*, 42.

AA. Space between dorsal and lateral shields with minute spinules in very many series.

B. Last dorsal shield of moderate size, more than ½ the one before it; anal 1½ in dorsal and beginning below its middle; dorsal 35, anal 37; dorsal shields about 15; lateral 38; ventral 10. *Lake Sturgeon*, 43.

BB. Last dorsal shield very small, less than ½ length of the one before it; dorsal 41; anal 22; anal entirely below dorsal and ½ as long; dorsal shields 11; lateral 32; ventral 9; snout about 4 in head. *Short-nosed Sturgeon*, 43.



Common Sturgeon

Acipenser oxyrhynchus Mitchill

Occurs from the St. Lawrence to the Carolinas, where it is most common and sometimes straggles around onto the Gulf coast.

This species is closely related to the European sea sturgeon and by some considered identical with it although it has been shown to have some slight differences in the number of plates.

Streams are ascended usually to about the reach of tide for the purposes of reproduction. Tremendous quantities of roe are liberated, those of a single female running as high as two or three million. The spent fish return to the sea, but the young remain in the rivers for at least a year.

Because of the relatively confined areas in which they spawn and the high value placed on their flesh and prepared eggs (caviare) overfishing has been easily accomplished and today they are rare for large stretches of their range. Also the high concentration of pollution about the lower reaches of so many of our rivers have greatly aided in this work of destruction. They are still taken in fair numbers in Chesapeake Bay.

The sturgeon egg is heavy and adhesive and deposited in spring or summer. They measure about $\frac{3}{32}$ of an inch in diameter and hatch in about six days at a temperature of 65° F. The average number produced by a female is in the neighborhood of a million and a half, although this may be greatly exceeded.

The tubular protractile mouth indicates their bottom feeding habit, as do the pendant barbels preceding it. Their method of feeding is to cruise slowly along dragging the barbels over the bottom. As soon as these sensory appendages come in contact with some food object the tubular mouth is shot downward so that it is directly over the morsel by the time it reaches the bottom, the fish usually not checking its pace. In fact it is rather difficult for a sturgeon to stop its forward motion abruptly because of the rather inflexible state of its paired fins. This is compensated for by the comparatively great distance between the sensory barbels and the mouth.

A length of 18 feet has been recorded from New England, but any in excess of 8 feet, at the present time, are unusual.

Lake Sturgeon *Acipenser rubicundus* Le Sueur

A fresh-water species inhabiting the Mississippi Valley, Great Lakes and northward, rarely descending to the sea.

Reaches a weight of up to 100 pounds but rarely encountered in salt or even brackish water.

Short-nosed Sturgeon
Acipenser brevirostrum Le Sueur

Known from Cape Cod to Florida, rare to the northward. So far as known its habits are apparently quite similar to those of the common sturgeon.

This species, always less common than the latter, does not reach such a large size, a length of 2½ feet being unusual.

The Gars—*Order Rhomboganoidea*

An order composed of a single family of essentially fresh-water fishes. They are characterized by closely fitting and very heavy rhombic scales which cover the entire body. The snout is long and in some species exceedingly attenuate. The jaws are armed with numerous sharp teeth for their entire length.

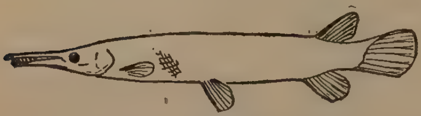
These fishes are of especial interest to paleontologists as they represent a once numerous group of which they are a mere vestige.

The Gars—*Family Lepisosteidæ*

The ordinal definition covers this family.

A. Jaws not very long; snout not quite as long as rest of head. *Alligator Gar*, 44.

AA. Jaws very long; snout over twice as long as rest of head. *Bong Gar*, 44.



Alligator Gar

Lepisosteus ferox (Rafinesque)

Occurs in the rivers of the southern states and northern Mexico, extending north to about St. Louis.

Although a huge, strong, and voracious fish, it is not infrequently found in bayous and ditches in which it is scarcely able to turn about. Its occurrence in the sea is mostly about the mouth of the Mississippi, where it lingers about refuse docks.

The alligator gar is armed with exceedingly heavy enameled scales which on a large one may even turn an axe.

Reaches a length of about 12 feet.

Bony Gar *Lepisosteus osseus* (Linnæus)

Occurs in the Atlantic and Gulf streams, rarely venturing into salt water.

Feeds chiefly on smaller fishes.

Spawns in shallow water in spring.

The short-nosed gar, *L. platostomus* Rafinesque, probably also descends to the sea at times. It may be distinguished from the alligator gar by the single row of teeth in the upper jaw instead of two and from the bony gar by its shorter snout which is only a little longer than the rest of the head.

Reaches a length of 6 feet.

THE CATFISHES—*Order Nematognathi*

Chiefly fresh-water fishes of both the old and new world which have a few marine representatives that never get very far away from river mouths or at least the coast. The marine forms may be readily recognized by the long barbels about the mouth, the adipose fins and their scaleless skin. Our

North American species, both fresh water and marine, belong to the family Siluridæ.

The Catfishes—*Family Siluridæ*

The ordinal discussion covers the family.

A. Nostrils close together, neither with a barbel; ventral fins with 6 rays.

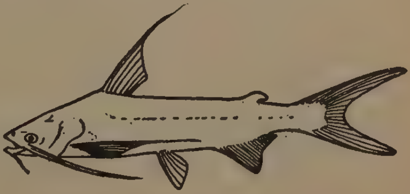
B. Lower jaw with 2 barbels; maxillary barbel flat and ribbon-like pectoral spine and dorsal with long filaments. *Gaff-topsail Catfish*, 45.

BB. Lower jaw with 4 barbels; maxillary barbel circular in section; no filaments on pectorals and dorsal. *Sea Çatfish*, 45.

AA. Nostrils far apart, the posterior one with a barbel, ventral fins with 8 or 9 rays. *White Catfish*, 46.

Gaff-topsail Catfish

Felichthys felis (Linnæus)



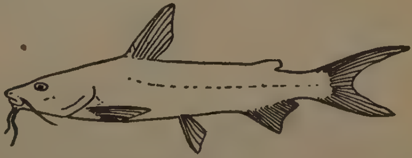
Known from Panama to Cape Cod, but not common north of Delaware.

The eggs of this species are extremely large, averaging about 22 mm. in diameter. They are carried about in the mouth of the male until hatched as are the young fish until they are about 3 inches and able to shift for themselves. A male of 22 inches may carry as many as 55 eggs in this manner. The yolk sac is absorbed before liberation, which may occupy about 65 days. On the Carolina coast breeding occurs in June and July.

Reaches about 2 feet in length.

Sea Catfish

Galeichthys milberti (Cuvier & Valenciennes)



Known from Texas to Cape Cod, but not common north of Virginia.

A very abundant species in the harbors of our Southern States. Active mostly at night.

Reaches a length of about 1 foot.

White Catfish *Ameiurus catus* (Linnæus)

A fresh water catfish rarely straying into brackish water. Coastwise streams from New York to Texas.

Spawns in summer in fresh water in a gravel nest. The parent fishes guard the eggs and young.

Reaches a length of about 2 feet and a weight of 5 pounds.

THE CARP-LIKE FISHES—*Order Plectospondyli*

A fresh water group characterized by numerous internal structures. Externally ours may usually be recognized by the characters given under the two families.

A. Maxillaries forming sides of margin of upper jaw, lower pharyngeal bones armed with a single row of comb-like teeth. *The Suckers*, 46.

AA. Premaxillaries alone forming margin of upper jaw; lower pharyngeal bones supporting 1 to 3 series of teeth, few in number. *The Carps*, 47.

The Suckers—*Family Catostomidæ*

A strictly fresh water family with only an occasional stray into brackish water. They may be recognized by the large fleshy, usually protractile inferior mouth, the toothless jaws, the lack of barbels, adipose fin and fin spines.

A. Lateral line interrupted or wanting; scales large; 35 to 50 in lateral series.

B. Lateral line absent; scales 36 to 45. *Chub Sucker*, 46.

BB. Lateral line present, more or less interrupted; scales 43 to 46. *Spotted Sucker*, 47.

AA. Lateral line complete and continuous; scales small, 55 or more in lateral series. *Common Sucker*, 47.

Chub Sucker *Erimyzon sucetta* (Lacépède)

Fresh waters from Maine to Texas, only rarely descending to brackish. Recorded from the brackish affluents of Chesapeake Bay.

Reaches a length of about 10 inches.

Spotted Sucker *Minytrema melanops* (Rafinesque)

Fresh waters from the Great Lakes to Texas. Recorded from the brackish affluents of Chesapeake Bay.

Reaches a length of 18 inches.

Common Sucker *Catostomus commersonii* (Lacépède)

Fresh waters from Quebec to Georgia. Recorded from brackish waters entering Chesapeake Bay.

Reaches a length of about 2 feet.

The Carps—*Family Cyprinidæ*

This family is normally a strictly fresh-water group, but occasionally an individual will straggle into brackish or even salt water. They are certainly out of their element and should be looked upon as abnormal visitors. They may be recognized usually by the rather large cycloid scales, no adipose fin, and may have a pair of maxillary barbels or none, no teeth in the jaws.

A. Mouth with 4 barbels; dorsal and anal each with 3 spines, the third in each serrate behind. *Carp*, 48.

AA. Mouth without barbels; dorsal and anal without spines.

B. Body in adult much compressed; belly behind ventrals compressed to a keel; lateral line strongly decurved; anal fin long; 14 to 16 rays; origin of dorsal behind ventrals. *Golden Shiner*, 48.

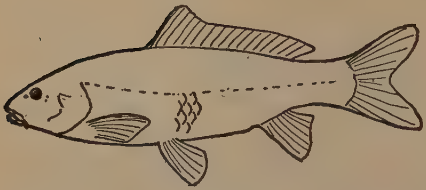
BB. Body not greatly compressed; belly rounder; lateral line only slightly decurved; anal fin short, 8 to 10 rays.

C. Peritoneum black; alimentary canal long, more than 3 times length of body. *Gudgeon*, 48.

CC. Peritoneum pale; alimentary canal short, less than 2 times length of body.

D. Lateral line complete; scales 37 to 41; no dark lateral band except in very young; base of caudal with a large dark spot. *Silver-fin*, 48.

DD. Lateral line incomplete, usually extending only to end of base of dorsal fin; scales 33 to 36; a prominent dark lateral band extending around tip of snout to base of caudal. *Bridled Minnow*, 48.



Carp
Cyprinus carpio
(Linnæus)
LaMonte, pl. 68

A species of Asiatic origin now wide spread throughout the world by fish culturists.

Occasional strays in Chesapeake and New York Bays entitle it to listing here.

Usually does not reach over 3 feet in length. 23 pounds is the American weight record.

Golden Shiner *Notemigonus crysoleucas* (Mitchill)

Fresh waters from Nova Scotia to Texas. Recorded from brackish streams entering Chesapeake Bay.

Reaches a length of up to 12 inches. LaMonte, pl. 69

Gudgeon *Hybognathus nuchalis* Agassiz

Fresh waters from New Jersey to Texas. Recorded from brackish streams entering Chesapeake Bay.

Reaches a length of about 6 inches.

Silver-fin *Notropis hudsonius* (DeWitt Clinton)

Fresh waters from the Great Lakes to Georgia. Those in the Delaware and Potomac Rivers form a recognizable race, *N. H. amarus* (Girard), which has a longer and more obtuse head and a faint or absent caudal spot.

Enters brackish waters of the Hudson and tributaries of Chesapeake Bay.

Reaches a length of about 5 inches.

Bridled Minnow *Notropis bifrenatus* (Cope)

Fresh waters from Massachusetts to Maryland. Sometimes enters brackish waters about Chesapeake Bay.

Reaches a length of about 2½ inches.

THE EELS—*Order Apodes*

Elongate, snake-like fishes naked or with rudimentary embedded scales, no ventral fins, sometimes also no pectorals.

the gill openings restricted to small lateral openings, no spines in the fins and no distinct tail-fin, it being completely absent or confluent with the long dorsal and anal.

The eels, like few other fishes, pass through a very distinct and curious larval period, when they look extremely unlike their parents. The eel larvæ, known as *leptacephali*, once considered distinct and separate fishes, are cigar-shaped in outline but very flat from side to side, (usually about as thick as an ordinary blotter) and highly transparent, so much so, indeed, that laid on a printed page they offer practically no obstruction to reading. The development of the common eel, discussed under that head, serves as an example and is probably not greatly different in its general aspects from the others about which we know little, barring the fact that it is only one of our eels that regularly enters fresh water.

A. Gill openings well developed; tongue present.

B. Skin covered with rudimentary imbedded scales, arranged in small groups at right angles to each other; pectorals and vertical fins well developed; lateral line present, tongue with free margins. *The Eels*, 49.

BB. Scales entirely absent.

C. Tip of tail with a fin, the dorsal and anal confluent around it.

D. Posterior nostril without a tube, entirely above upper lip.

E. Tongue broad, largely free in front and on sides, teeth on vomer moderate. *The Conger Eels*, 51.

EE. Tongue narrow, adnate to the floor of mouth or only with the tip slightly free; teeth on vomer well developed, sometimes large. *The Pike Eels*, 51.

DD. Posterior nostril close to edge of upper lip; teeth nearly equal; tongue adnate to floor of mouth. *The Worm Eels*, 52.

CC. Tip of tail without rays, projecting beyond the dorsal and anal; posterior nostril on edge of upper lip; anterior nostril near tip of snout, usually in a small tube. *The Snake Eels*, 52.

AA. Gill openings small; nearly circular; tongue absent; pectorals absent; no scales. *The Morays*, 55.

The Eels—*Family Anguillidæ*

Eels recognized at once by their peculiar imbedded scales.

Common Eel
Anguilla rostrata
(Le Sueur)

Known from the Gulf of St. Lawrence to Central America, extending southward to Brazil.

Although spawning only in the sea, the eel enters fresh water and travels great distances inland overcoming difficult obstacles of a remarkable degree. So far as known, only the females penetrate far inland, the males, which do not attain such a great size, travel little above tide water. Spends the colder weather hibernating in the mud. Just how long eels normally remain in inland waters is unknown, but in instances of land-locked specimens they may remain for years and attain a great size.

The eel is an omnivorous feeder, although its much-discussed scavenger propensities appear to be associated with the relative abundance of other more inviting types of food.

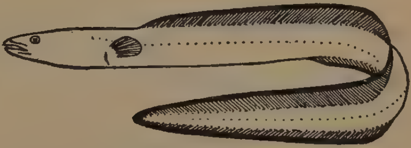
On reaching maturity the eels descend to the sea and by some almost uncanny instinct find their way to an area southwest of Bermuda, between these islands and the Bahamas. This downstream migration takes place during all the warmer months, and is one from which there is no return, the parents dying after spawning. The eggs are very minute and hatch into the very uneel-like larvæ, the *leptocephalus*, described under the family head. From the time of hatching the young eels gradually work back to the continent, assisted by favorable currents. By the time they reach our coast they are out of the *leptocephalus* stage and have the form of the mature eels, but are still highly transparent. As soon as they come under the influence of fresh water in our brackish bays they become heavily pigmented, being nearly black, and start the ascension of streams and complete the cycle. Frequently great hordes of eels of about 2 inches long may be seen struggling with the current in dense masses nearly solid "eel."

Reaches a length of 4 or 5 feet.

The Conger Eels—*Family Leptocephalidæ*

Eels superficially resembling the common eel, but with scaleless skins.

Conger Eel
Leptocephalus conger Linnæus



Almost cosmopolitan in warm and temperate seas of the northern hemisphere, except the eastern Pacific.

Unlike the common eel, the conger eel does not enter fresh water, nor habitually live close to shore. It feeds largely on fish such as herring, butterfish, eels, etc., and to a certain extent on marine worms.

The conger eel moves off shore to spawn, and dies on its completion. As the season approaches, the fishes undergo considerable change of appearance. Teeth are lost, the shape of the head alters, and the eyes of the male become much larger. The tiny and exceedingly numerous eggs hatch into thin, transparent larvæ similar to those of the common eel.

Reaches a length of 8 feet and a weight of 12 pounds. This is exceptional, and over 4 feet is unusual.

The Pike Eels—*Family Murænesocidæ*

Eels with the posterior nostril not near the lip and with the tongue largely adnate. They are chiefly deep water forms and tend to have rather long snouts.

A. Body moderately elongate, the diameter more than $\frac{1}{30}$ the length; dorsal origin just before vent. *Slender Pike Eel*, 51.

AA Body whip-shaped, the diameter less than $\frac{1}{50}$ the length; dorsal origin just behind nape. *Horsehair Eel*, 52.

Slender Pike Eel *Neoconger mucronotus* Girard

A small rare form from the coast of Texas. Possibly a stray from rather deep waters.

Horsehair Eel *Gordiichthys irretitus*, Jordan & Davis

A rare eel reaching 2½ feet, known from the Snapper Banks of West Florida, but only from the stomachs of other fishes.

The Worm Eels—*Family Myridæ*

Small tropical worm-like eels that may be known from the key characters.

A. Dorsal beginning behind vent; no vomerine teeth. *Worm Eel*, 52.

AA. Dorsal half-way between gill opening and vent; vomerine teeth present. *Speckled Worm Eel*, 52.

Worm Eel

Ahlia egmontis (Jordan)

A slender brown eel reaching up to 15 inches. Originally described from Egmont Key, Florida, but occurring more or less frequently in the West Indies.

Speckled Worm Eel *Myrophis punctatus* Lutken

Common on the Gulf coast, West Indies and south to Surinam.

A small species about which little is known.

The Snake Eels—*Family Ophichthyidæ*

Tropical eels usually of bright colors and ornate pattern which are readily recognized by the tail, which is bare of any fin, the dorsal and anal not reaching to its tip.

A. Body without traces of fins anywhere; gill openings near together, subinferior; anterior nostril tubular; mouth small. *Kendall's Eel*, 53.

AA. Body with distinct fins, at least on back.

B. Anal fin wholly absent; no pectorals; dorsal high, beginning on head, gill openings subinferior; anterior nostril tubular. *Sail-bearing Eel*, 53.

BB. Anal fin well developed; anterior nostril usually in a tube near tip of snout.

C. Teeth blunt, mostly molar; pectorals present, small; dorsal rather high, beginning on head before gill opening. *Sharp-tailed Eel*, 54.

CC. Teeth all pointed, none molar.

D. Dorsal fin beginning before nape, on anterior part of head; pectorals small or absent.

E. Pectorals absent; body compressed, the dorsal high. *Blotched Snake Eel*, 54.

EE. Pectorals small, but present; body not especially compressed, the dorsal moderate.

F. Pectoral a slender rudiment not longer than eye; head about 8 in trunk. *Whip Snake Eel*, 54.

FF. Pectoral nearly as long as snout; head about 10 in trunk. *Dark Snake Eel*, 54.

DD. Dorsal fin beginning behind gill opening; pectoral fins well developed.

G. Teeth about equal, with no elongate canines on jaws or vomer.

H. Teeth of lower jaw uniserial or nearly so; sides of body with large round whitish spots; dorsal inserted behind tip of pectorals. *Pensacola Snake Eel*, 54.

HH. Teeth of both jaws in 2 series.

I. Vomerine teeth in 1 row, teeth in both jaws biserial, body spotted with white.

J. Dorsal beginning an eye's diameter behind tip of pectoral. *Florida Snake Eel*, 54.

JJ. Dorsal beginning over or before tip of pectoral. *Spotted Snake Eel*, 55.

II. Vomerine teeth in 2 rows; body plain brownish; pectoral equal to mouth cleft. *Gomes' Snake Eel*, 55.

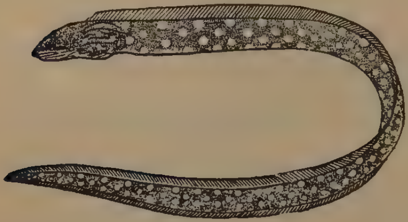
GG. Teeth unequal, some long canines in jaws; teeth on vomer small; body with black spots. *Spoon-nosed Snake Eel*, 55.

Kendall's Eel *Verma kendalli* (Gilbert)

Known from the coast of Florida in rather deep water, probably rarely reaching our range. Brown in coloration with speckles.

Sail-bearing Eel *Letharchus velifer* Goode & Bean

Coast of Florida in rather deep water, probably rarely reaching our range. Known only from the "Snapper Banks" off Pensacola and Tampa. Body plum-colored. Dorsal fin white-edged with a broad black band.



Sharp-tailed Eel
Myrichthys acuminatus
(Gronow)

West Indies, reaching northward to the Florida Keys. Brown in color with large, nearly circular spots in two rather regular series on each side.

Blotched Snake Eel *Callechelys murœna* Jordan & Evermann

Known from one specimen from the Pensacola Snapper Banks. Dark olive blotched with darker and blackish, belly scarcely paler, dorsal and anal with pale margins.

Whip Snake Eel *Bascanichthys scuticaris* (Goode & Bean)

West Indies; fairly common on the west coast of Florida. Brown above, lighter below, dorsal and anal pale, without dark margins.

Dark Snake Eel *Bascanichthys bascanium* (Jordan)

One specimen known, from Egmont Key, Florida. Very similar to the Whip Snake Eel, but with a shorter head.

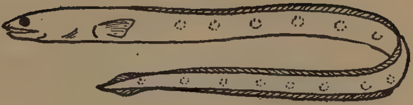
Pensacola Snake Eel *Ophichthus retropinnis* Eigenmann

Known from the Snapper Banks off Pensacola, Florida. Very similar to the Spotted Snake Eel in appearance, but with different teeth.

Florida Snake Eel *Ophichthus guttifer* (Bean & Dresel)

Known from the Snapper Banks off Pensacola, Florida. Very similar to the Spotted Snake Eel, but with the dorsal commencing further back.

Spotted Snake Eel *Ophichthus ocellatus* (Le Sueur)



West Indian, occurring from Brazil to Pensacola, Florida. Fairly common.

Color rather dark brown above, lighter below, with about 20 circular light spots along the side, anal light yellow, pectoral dusky.

Gomes' Snake Eel *Ophichthus gomesei* (Castelnau)

Known from Rio de Janeiro to South Carolina. Common about the Florida Keys.

Olive brown above, light yellow below, dorsal and anal translucent with dark edgings.

Spoon-nosed Snake Eel *Mystriophis intertinctus* (Richardson)

West Indian north to Pensacola, Florida. Fairly common.

Dark brown above, paler below, sides with 2 rows of large black spots.

The Morays—*Family Murænidæ*

Eels, all of which lack pectoral fins and have a small, nearly circular gill opening. The skin is thick and leathery. They are typically fishes of coral reefs and spend much of their time insinuated in the interstices of such formations.

A. The vertical fins well developed; the dorsal beginning before vent.

B. Teeth all, or nearly all, acute, none in jaws obtuse or molar-like.

C. Posterior nostril without a tube, the margin sometimes slightly raised, dorsal inserted on head, considerably before gill opening.

D. Teeth all entire with no serrations anywhere and none of them with basal lobes.

E. Dorsal with a distinct black margin; and with a pale edge; color brownish, finely mottled with darker. *Brown Moray*, 56.

EE. Dorsal without a distinct black margin; color various.

F. Color in the form of rounded spots more or less confluent, sometimes obscuring the pale ground color. *Spotted Moray*, 56.

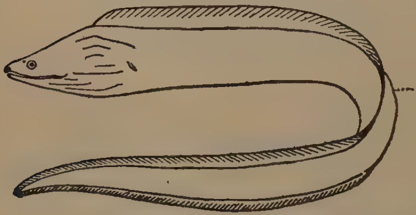
FF. Color plain bright green, brown or gray. *Green Moray*, 56.

DD. Teeth serrate in part; color brown with irregular light yellowish spots irregularly placed; dorsal black edged. *Ocellated Moray*, 57.

CC. Posterior nostril with a conspicuous tube, as well as anterior; gill opening black; body with well defined reticulations. *Reticulated Moray*, 58.

BB. Teeth mostly obtuse, molar-like, only the anterior nostril tubular; color brownish, marbled and barred with paler. *Chained Moray*, 58.

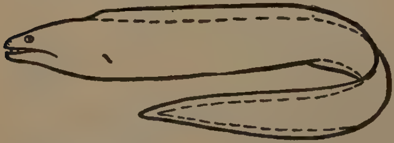
AA. Vertical fins rudimentary, confined to end of tail, color yellowish brown with about 15 irregular broad chocolate cross bars. *Banded Moray*, 58.



Brown Moray
Gymnothorax vicinus
(Castelnau)

West Indies north to the Florida Keys. Rare in our range, in rather deep waters.

Reaches a length of about 4 feet.



Spotted Moray
Gymnothorax moringa
(Cuvier)

West Indies, Pensacola, Florida, to Rio de Janeiro and St. Helena. Common, probably the most abundant West Indian Moray.

Very variable in coloration, although the pattern is fairly constant.

Feeds on small fishes.

Reaches a length of about 3 feet.

Green Moray *Gymnothorax funebris* Ranzani

Tropical America on both coasts. On our coast common from the Florida Keys to Rio de Janeiro. Like so many

West Indian types it also has found a satisfactory residence about the Bermudas.

Although the color is usually a brilliant green, it may be brownish or slaty gray and sometimes slightly mottled. One component of the green color is carried in the abundant mucous itself. That is, if the slime is carefully scraped off a patch, a bluish-slate skin will be revealed, and the slime itself will be found to be a brilliant yellow. When viewed in combination, the bright green is produced. We know of no other fish that is colored by such a means, the mucous being uniformly transparent in other species. An abnormal absence of this yellow color in the mucous may account for the grayish individuals sometimes encountered.

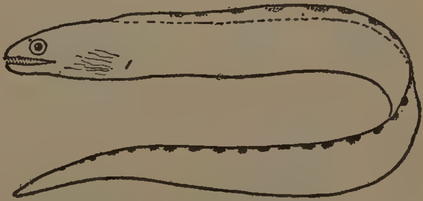
As the moray reaches a large size, being our largest eel, it is feared greatly by fishermen and there is no question of its ferocity. The jaws are powerful and armed with dangerous teeth which may carry a certain amount of toxic substances along with them. Brought aboard a small skiff, it is an ugly customer.

In our waters it is not valued as food, but in Bermuda it ranks among the highest in market value.

Reaches a length of 6 feet and possibly more.

Ocellated Moray

Gymnothorax ocellatus Agassiz



Known from Pensacola, Florida, to Rio de Janeiro. Common.

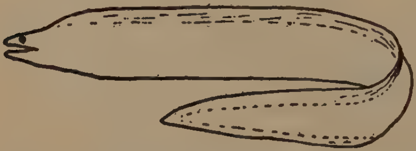
Very variable in color.

Straggles north to New Jersey.

Reaches a length of usually not more than 18 inches.

A race, *G. o. saxicola* (Jordan & Davis), has been recognized from Pensacola in which the spots are everywhere wider than the dark interspaces, giving the appearance of a dark network on a light ground. Another, *G. o. nigromarginatus*

(Girard), from St. Joseph Island, Texas, has very small stellate spots, smaller than the eye.



Reticulated Moray
Muræna retifera Goode & Bean

Known from off the coast of South Carolina, straggling rarely north to Massachusetts. Tends to keep in deep water.

Chained Moray *Echidna catenata* (Bloch)

West Indies from Bermuda to Surinam. Should be expected in Florida waters.

Banded Moray *Channomoræna vittata* (Richardson)

Known from Cuba and Bermuda. Should be expected in Florida waters.

THE HERRING-LIKE FISHES—*Order Isospondyli*

A large order containing a variety of soft-rayed fishes, which agree in a number of chiefly osteological characters which need not concern us here. The key to the families will serve to locate any of our forms. Externally they may usually be recognized in addition by the lack of spines in the vertical fins, by the abdominal position of the ventral fins, the generally well-forked tail and the frequent presence of a small tab on the back after the single dorsal fin (the adipose fin) and the lack of barbels of any sort.

A. No adipose fin.
B. A plate present between the branches of the lower jaw (gular plate); mouth large; teeth present, all pointed; axillary scales and sheaths prominent.
C. Last dorsal ray produced as a long filament. *The Tarpons*, 59.
CC. Last dorsal ray not produced. *The Ten Pounders*, 60.
BB. No gular plate.
D. Lateral line well developed; mouth small, horizontal, posterior part of tongue and roof of mouth paved with coarse teeth. *The Bonefishes*, 60.
DD. Lateral line absent.

E. Maxillary not excessively long, mouth terminal or nearly so; sometimes the last dorsal ray elongate.

F. Maxillary simple; the mouth not quite terminal; the last dorsal ray produced; stomach gizzard-like. *The Gizzard-shads*, 61.

FF. Maxillary of about 3 pieces; mouth terminal or even slightly superior; the last dorsal ray seldom produced; stomach not gizzard-like. *The Herrings*, 62.

EE. Maxillary excessively long, reaching to or nearly to the gill-opening; mouth distinctly inferior overhung by a long snout; last dorsal ray never elongate. *The Anchovies*, 70.

AA. Adipose fin present.

G. Pyloric cæca many; stomach not as a blind sac. *The Salmons*, 72.

GG. Pyloric cæca few, stomach a blind sac. *The Smelts*, 74.

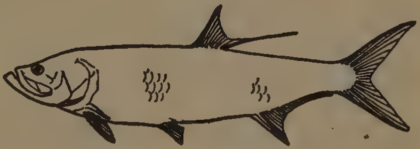
The Tarpons—*Family Megalopidæ*

A single species of this family is present in our waters. It may be recognized by the dorsal fin which is inserted well behind the ventrals and has the last ray produced into a long wisp, the falcate condition of the long anal and the fishes usually large size.

Tarpon

Tarpon atlanticus
(Cuvier &
Valenciennes)

LaMonte, pl. 5



Known chiefly from our Gulf Coast but straggling north to Cape Cod. It is, of course, famous as a sportsman's fish and is caught in quantities, chiefly in estuaries and river mouths of the south. For most part white men do not value it as food but angle for it chiefly for the "kill". This is not true of Central American Indians, many of whom value it highly as a food fish. The exceedingly large firm scales of this fish are often worked into novelties of various sorts. The scales from a large fish may reach as much as three inches across.

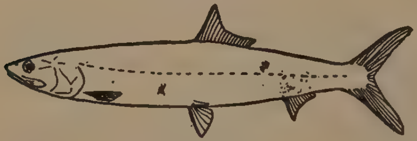
The produced last dorsal ray functions in the tremendous leaps that the tarpon is famed for. It is concave below and adheres to the side of the fish, bending and securing the dorsal to the right or left, so determining the direction of the fall.

Popular as this fish is with anglers, little is known of its life history beyond the fact that the eggs ripen in summer and are exceedingly numerous. One estimate placed twelve million in a 142 pound fish. Only a few records of tarpon under a foot in length have been made and what they look like in the larval stage may only be guessed at.

They reach a large size and records run as high as 8 feet 2 inches with an estimated weight of 350 pounds.

The Ten Pounders—*Family Elopidæ*

A single species which may be recognized by its complete silvery coloration, the fact that the belly is not compressed or covered with specialized scales, no adipose fin, the dorsal not in advance of ventrals, and an elongate bony plate between the branches of the lower jaw and the highly developed membranous sheaths at the fin bases when viewed from below:



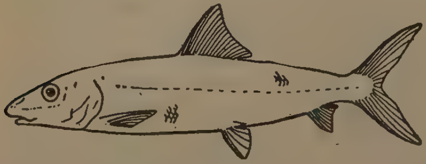
Ten Pounder
Elops saurus
Linnæus

Known from all warm seas, on our coast north to Cape Cod in the warmer months. Not common north of North Carolina.

Reaches a length of 3 feet.

The Bonefishes—*Family Albulidæ*

This family is of a single species which may be recognized by the inferior, somewhat pig-like mouth, the dorsal insertion being in advance of the ventral fins, and the scarcely compressed body.



Bonefish
Albula vulpes
(Linnæus)

La Monte, PL.5

Known from all warm seas, extending northward on our coast to Cape Cod.

The bonefish is valued by anglers on account of its gamy qualities but is not of any particular food value. It appears never to occur in such vast schools as is so common with its near relatives, the herrings.

As their inferior mouths suggest, they are bottom feeders and represent the only species in the order within our territory of which this is true, their relatives all feeding for the most part exclusively in open water.

The larvæ of this species is unique in somewhat resembling the curiously specialized larvæ of the eel. That is, it is a flattened and transparent band-shaped creature rather different from the larvæ of its near relatives. These are common at the surface at night in West Indian harbors.

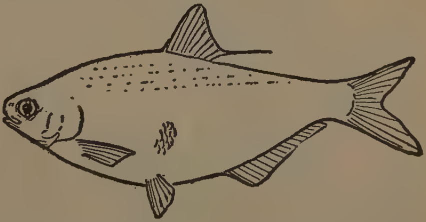
Records for size run to 31 inches and of weight to 14 pounds.

The Gizzard Shads—*Family Dorosomidæ*

Isospondylous fishes with short deep bodies, strongly compressed, belly armed with bony serratures, mouth small inferior, no teeth, no lateral line, no adipose fin, stomach short, muscular like a bird's gizzard.

Gizzard Shad

Dorosoma cepedianum (Le Sueur)



Known from Cape Cod to Mexico but not common north of Virginia.

A fish of brackish and fresh waters, not abundant in true sea water.

Feeds largely on micro-organisms.

Lives well under land-locked conditions. It, however, makes definite "runs" in streams for spawning purposes.

Of no food value.

Reaches a length of about 15 inches.

The Herrings—*Family Clupeidæ*

Silvery fishes, more or less compressed, with no lateral line, mouth large, teeth very small or absent, gill-rakers very long and fine, belly frequently trenchant with keeled scutes, dorsal fin median or slightly posterior, caudal forked.

A. Belly rounded, covered with ordinary scales; anal fin short, 13 to 17 rays.

B. Dorsal short, 11 rays; anal 17; ventrals inserted nearly under dorsal insertion, which is nearer snout than caudal base; a distinct lateral silvery band. *Dwarf Herring*, 63.

BB. Dorsal long, 18 rays; anal 13; ventrals inserted much behind dorsal; no distinct lateral silvery band. *Round Herring*, 63.

AA. Belly compressed, armed with bony serræ; anal fin moderate, 15 to 25 rays; dorsal nearly opposite ventrals.

C. Scales with their margins entire and rounded.

D. Last ray of dorsal not produced.

E. Adipose eyelid present.

F. Vomer with teeth; ventral scutes weak; ventral fins below middle of dorsal. *Sea Herring*, 64.

FF. Vomer without teeth; ventral scutes strong, the belly compressed; ventral fins under or slightly behind origin of dorsal.

G. Cheeks longer than deep; tip of upper jaw scarcely notched.

H. Peritoneum pale.

I. Head long about 4; form rather elliptical; tip of snout and lower jaw conspicuously dusky; gill-rakers 19 to 21. *Hickory Shad*, 65.

II. Head shorter about 4.66, body heavier forward; eye about equal to snout; gill-rakers 25 to 50. *Alewife*, 65.

H. Peritoneum black; eye longer than snout; gill-rakers 25 to 50. *Glut Herring*, 66.

GG. Cheeks deeper than long; tip of upper jaw deeply notched, receiving the slender pointed tip of the lower; jaws toothless. *Shad*, 66.

EE. Adipose eyelid obsolete; teeth small but permanent.

J. Body very elongate, the depth 4.5; head 4.5; a black opercular spot. *Spanish Sardine*, 67.

JJ. Body deep, 3.0 to 3.8; head 3.0 to 3.9; no black opercular spot.

L. Each scale with 4 vertical wavy striæ; no humeral spot; eye 2.5 in head; depth 3.4; scales not adherent or firm. *West Indian Sardine*, 68.

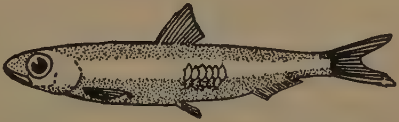
LL. A humeral spot usually present; scales adherent and firm, those on back with strong horizontal striæ; body moderately elongate, the ventral outline not strongly arched; depth 3.33 to 3.4; head 3.43; eye 2.66 in head. *Big-eyed Sardine*, 68.

DD. Last ray of dorsal produced into a long filament. *Thread Herring*, 68.

CC. Scales with their margins vertical and pectinate or fluted, head large, no teeth. *Menhaden*, 69.

Dwarf Herring

Jenkinsia lamprotænia
Gosse



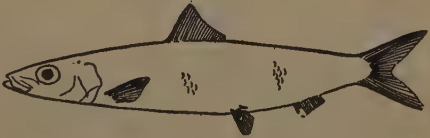
Known from the Gulf of Mexico from Key West to Yucatan.

One of the smallest herrings occurring in great schools frequently mixed with anchovies of about its own size. In a general way it resembles an anchovy. It frequents the surf as well as open water. This fish is of considerable dietary importance to animals feeding on small fishes because of its abundance and the nature of the closely packed schools.

Reaches a length of 2 inches.

Round Herring

Etrumeus teres
(De Kay)

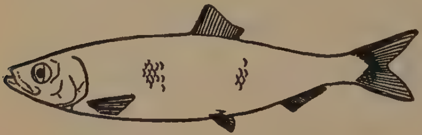


Differs from all our other herrings in being only very slightly compressed and lacking a semblance of a trenchant ventral outline.

Known from Maine to the Gulf of Mexico. Rare in the northern part of its range, seldom passing beyond Cape Cod, but fairly common to the southward.

Nowhere sufficiently common to rank as a commercial species.

May attain a length of 15 inches.



Sea Herring
Clupea harengus
Linnæus

The herring of commerce, abundant in the north Atlantic on both coasts and straggling south of Cape Hatteras, on our coast, in winter. Although it may be found at any time of year in the latitude of New York, it is only abundant in the colder months.

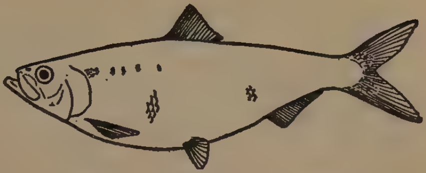
From any standpoint, economic or philosophic, the herring is of great importance in the north Atlantic, if by virtue of its vast numbers alone. It swims in schools usually of great dimensions and like so many of the members of this family feeds chiefly on minute organisms suspended in the sea water known under the common head of plankton. Much of this is made up of small forms of crustaceans. The herring is able to utilize this food source by virtue of a very delicate sieve-like arrangement attached to the bony arches supporting the gill membranes. This living sieve, the gill-rakers, makes it possible for the fish to strain out whatever minute food particles may be in the water simply by opening its mouth and swimming forward. They are, however, not restricted to this method of feeding alone and may pursue objects of a larger size.

Herring are, in turn, because of their great numbers, the staple food of many of our larger predacious fishes.

They spawn in the fall, in the latitude of New York in November. The eggs are heavy and adhesive and are usually found attached to stones or seaweed. An average female may deposit upwards of 30,000 eggs in a season. The eggs are about 1.25 mm. in diameter and hatch in about 22 days at a temperature of 45° F. On hatching they are about 6 mm. long and reach maturity in about the third year.

They generally do not reach over a foot in length although 18 inches has been recorded.

Hickory Shad
Pomolobus mediocris
(Mitchill)



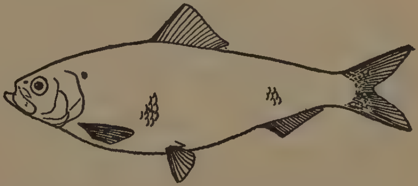
This and the two following species are of rather difficult differentiation to the amateur and in their smaller sizes to the professional not especially familiar with them. All are anadromus, ascending streams for the purpose of spawning, and of generally similar habits. The accompanying key and figures should be carefully followed in an attempt to determine specimens of this genus.

The hickory shad is known from Cape Cod, sometimes north to Maine, to Florida.

Unlike the sea herring, this species feeds almost exclusively on objects of a fair size, pursuing and catching small fish such as silversides, anchovies and the young of other species as well as fairly large crustacea.

Reaches a length of 2 feet and a weight of 2½ pounds.

Alewife
Pomolobus pseudoharengus
(Wilson)
LaMonte, pl. 66



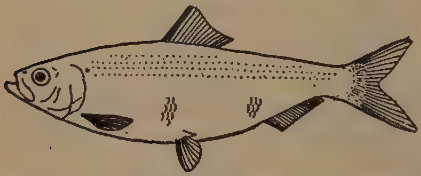
Known from Nova Scotia and the Gulf of St. Lawrence to the Carolinas.

Unlike the hickory shad but like the sea herring, the present species feeds to a large extent on minute plankton, and its "sieves" seem to be even finer, often retaining microscopic plants, diatoms, the ultimate source of oceanic food stuffs.

In spawning, streams are ascended and the eggs are deposited either there or frequently in ponds. The peak of the run generally antedates the first run of shad by a little. This occurs in April or May and by the fall the young fish have found their way to the sea where they remain until mature, about three years later. The average female deposits about

100,000 eggs, which are heavy and adhesive. They are rather similar to those of the sea herring in both size and appearance. They hatch in about 6 days at a temperature of 60° F. Throughout their range they apparently reach 3 or 4 inches by the first fall.

They may attain a length of nearly 15 inches.



Glut Herring

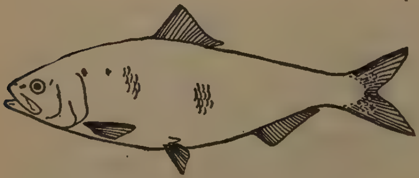
Pòmolobus æstivalis
(Mitchill)

Known from Nova Scotia to Florida. This species is closely similar to the preceding and they have broadly overlapping ranges, the former being more abundant northward and the present more abundant southward.

Unlike the alewife, the glut herring seldom reaches far above the limits of brackish water for the purpose of spawning. The season is more protracted and does not reach its peak before the beginning of summer. The eggs are about 1.0 mm. in diameter, slightly adhesive and heavy. They hatch in a little over 2 days at a temperature of 72° F. The young may reach nearly 2 inches by the time winter sets in the latitude of New York.

Both this and the preceding species are of some economic importance, frequently going together under the one name of river herring.

A length of over a foot may be attained by this species.



Shad

Alosa sapidissima
(Wilson)

LaMonte, Pl. 26

Known from the Gulf of St. Lawrence to Florida.

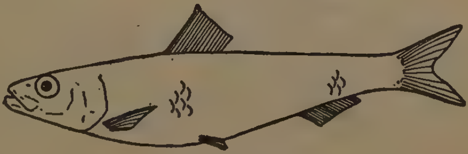
The shad is by far the most sought after species of this family for purposes of food. As a consequence of this and its anadromous habits (ascending streams to spawn) it has been greatly reduced in numbers for it is relatively easy for immense catches to be made when the fishes are massed in lower waters of rivers. In the southern part of their range shad enter the rivers as early as January while at the northern end the run does not begin before June. This is largely determined by the temperature, the runs not beginning in streams before the temperature reaches at least 50° F. In addition to over-fishing, pollution has played much havoc with the shad, but because of its great economic importance we know probably more of its habits than any other clupeoid, excepting the sea herring, as a consequence of the stimulation its economic importance has given investigators. In the annual runs to the spawning grounds the males arrive first followed shortly thereafter by the females. The average number of eggs per female is about 28,000 but sometimes reaches as much as 156,000. They are barely heavy enough to sink in fresh water, are not adhesive and average about 3 mm. in diameter. They hatch in about a week at a temperature of 60° F. By the first winter an average length of about 6 inches is reached. Maturity is reached in the third or fourth year.

Like most of the other species of this family the shad is largely a plankton feeder, and as a consequence the bulk are taken in nets, chiefly gill nets.

The average size is somewhat under 2 feet with a weight of about 4 pounds. The record on our coast is 13½ pounds with a length of about 2½ feet.

Spanish Sardine

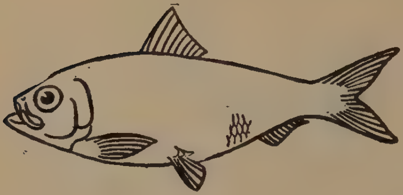
Sardinella anchovia (Cuvier & Valenciennes)



One of the smaller herrings known from Cape Cod to Rio de Janeiro, rare throughout the northern extent of its range.

Feeds largely on small planktonic crustacea, mostly copepods.

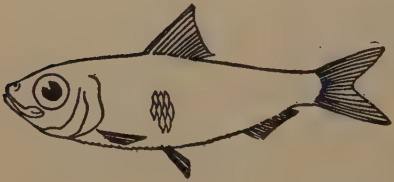
Attains a length of usually not more than 6 inches.



West Indian Sardine

Sardinella sardina
(Poey)

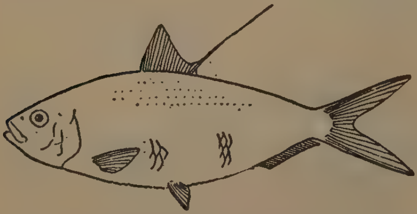
Known from the West Indies north to Florida.
Feeds largely on the larger plankton organisms.
Reaches a length of 8 inches.



Big-eyed Sardine

Sardinella macropthalmus
(Ranzani)

Known from Florida to Brazil. Common about the Florida Keys.
Reaches about 6 inches in length.

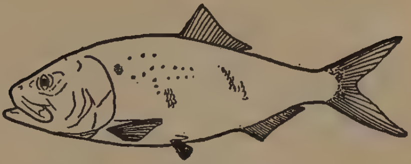


Thread Herring

Opisthonema oglinum
(Le Sueur)

A typically West Indian herring straying north on our coast only irregularly north of Virginia, reaching Cape Cod occasionally.
Feeds largely on plankton.
Reaches about 12 inches in length.

Menhaden
Brevoortia tyrannus
(Latrobe)



Known from Nova Scotia to Brazil. Although not a food fish, it is of great value for its richness in oil, which, although making it unsuitable for food, renders it of service to industry. The waste, after the oil is extracted, is used extensively as fertilizer.

On account of the variation in ocean temperatures on our coast, menhaden may be found spawning at some point practically throughout the year. The eggs are buoyant, non-adhesive and average about 1.5 mm. in diameter. They hatch in about 2 days at a temperature of 72° F. Maturity seems to be reached in about 3 years.

They average a little less than a foot in length, although there is a record of one of 18 inches.

They feed exclusively on plankton, their exceedingly delicate gill-rakers holding the most minute particles, including even diatoms. Some kept at the New York Aquarium in 1923 were successfully fed pulped clam and fish flesh. They would cross and recross the cloud of material thus delivered to them with mouths agape, evidently straining out the particles but took not the slightest notice of an occasional large piece drifting by. In this connection it might be noted that rarely are clupeids to be found in an aquarium. This is primarily, at least, because these fishes are exceedingly susceptible to handling and often simply dipping them out of the water with a soft dip net is sufficient to ruin them. It is not clear just why the particular specimens referred to above survived the journey from lower New York Bay to the Battery. After once established they appeared to do well.

Usually menhaden are found in great compact schools, which is characteristic of so many members of this family. Often these schools are at the surface and attacked from both above by sea birds and below by predacious fishes.

Two races have been recognized within our area, *B.t. brevicaudata* Goode, with the caudal not longer than the pectorals from Connecticut south blending to the typical form, and *B.t. patronus* Goode of the Gulf of Mexico grading into the typical form *B.t. tyrannus* (Latrobe) around the Florida peninsula. The dorsal height is greater than the maxillary length and the other fins are generally longer than in the typical form.

The Anchovies—*Family Engraulidæ*

Small compressed delicate fishes with a single dorsal fin and a deep undershot mouth cleft, living in large compact schools usually in open water, but frequently close to shore in warm and temperate seas. There is usually a distinct silvery lateral stripe.

Used commercially to make Anchovy paste.

There are numerous other species just south of our range that may be expected to appear in it.

A. Anal rays 14 to 16; body slender, compressed, the depth 5 to 6, lateral band well defined.

B. Maxillary short, not quite reaching margin of preopercle; anal 14 to 16. *Flat Anchovy*, 70.

BB. Maxillary moderate, reaching beyond preopercle nearly to gill opening, anal 16. *Sheathed Anchovy*, 71.

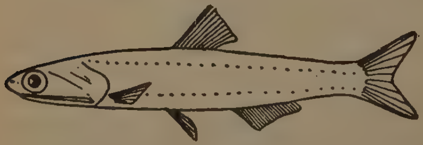
AA. Anal rays over 16.

C. Anal rays 25 or 26; lateral band diffuse or obsolete, scarcely wider than pupil. *Common Anchovy*, 71.

CC. Anal rays 19 or 20.

D. Maxillary short, not reaching root of mandible, lateral band diffuse, about ½ broader than eye; anal 19. *Silvery Anchovy*, 71.

DD. Maxillary long, reaching nearly or quite to gill-opening, lateral band well defined, as broad as eye; anal 20. *Striped Anchovy*, 71.



Flat Anchovy

Anchoviella perfasciata
(Poey)

A West Indian species, recorded merely as a straggler as far north as New York.

Not known to exceed 5 inches in length.

Sheathed Anchovy *Anchoviella perthecatus* (Goode & Bean)

Known from Florida.

Reaches a length of about 4 inches.

Common Anchovy

Anchoviella mitchilli (Cuvier & Valenciennes)

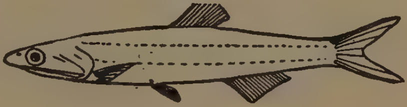
Known from Maine, although rare north of Cape Cod, to Texas. A fish of sandy shores, generally abundant where found.

Spawning occurs in July and August, and the act is supposed to be performed at dusk. The eggs are similar to those of the silvery anchovy, but their longer axis averages about 0.6 mm. They hatch in about 24 hours, but due to internal changes sink when a little more than half incubated.

Reaches a length of 4 inches.

Silvery Anchovy

Anchoviella argyrophanus (Cuvier & Valenciennes)



A Gulf Stream species touching our shores irregularly.

This species spawns in July and August. The eggs are buoyant, elliptical in shape, which is unusual in fishes, and average about 1.2 mm. along their greater axis. Attains the size of about 6 inches.

Striped Anchovy

Anchoviella epsetus (Bonnaterre)

Known from Cape Cod to Uruguay, although typical of the West Indies and abundant in Florida.

In the northern part of their range they are known to spawn as late as August.

Feed chiefly on copepods and other small organisms of a generally similar nature.

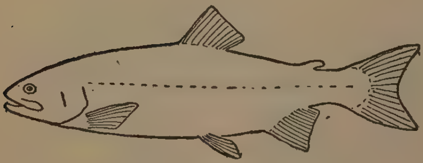
In Florida, where they are very abundant, they are frequently found in company with the hardhead silverside in the vicinity of docks and piling.

They attain a length of a little over 6 inches.

The Salmons—*Family Salmonidæ*

Body elongate, covered with cycloid scales, an adipose fin present, mouth large, armed with jaw teeth, either entirely fresh water or anadromous in nature.

A. Anal fin long, 15 rays, scales very small, about 200 in lateral line. *Humpback Salmon*, 72.
AA. Anal fin short, 9 to 12 rays.
B. Vomer flat, with teeth, body black spotted.
C. Vomerine teeth weak, little developed, scales about 120, no lateral line. *Atlantic Salmon*, 73.
CC. Vomerine teeth well developed, scales about 120 to 130, a vague red or yellowish lateral band. *Rainbow Trout*, 73.
BB. Vomer boat-shaped, toothless, scales about 200, spotted with red outlined with blue. *Brook Trout*, 74.



Humpbacked Salmon
Oncorhynchus gorbuscha (Walbaum)
LaMonte, Pl. 46

Occurs naturally in the Pacific from Oregon northward on the American side. Introduced into New England in 1913.

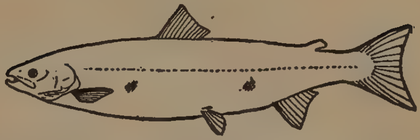
They have survived and apparently have successfully spawned in some of the streams draining into the Gulf of Maine.

Spawning takes place in fall at a temperature of 54 to 60° F. Like other Pacific salmons they die after spawning once.

The smallest of the Pacific salmons, averaging about 5½ pounds and 2 feet in length but reaching up as high as 11 pounds.

Atlantic Salmon

Salmo salar
Linnæus
LaMonte, PL. 47



Known from the north Atlantic on both coasts ascending favorable rivers north of Cape Cod to Hudson Bay. Now largely extirpated at the southern limits of its range because of pollution and overfishing. Supposed to have formerly been abundant in the Hudson River and in the Delaware.

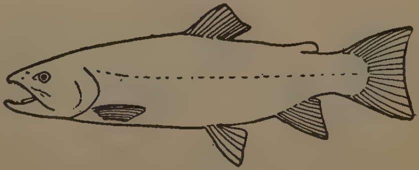
The Atlantic salmon spawns far up in cold streams in October and November. The eggs do not hatch before April or May. They are heavy and not adhesive and average about 7 mm. in diameter. A female may deposit over 9,000. Records read up to 21,000. As found on the spawning beds they are usually covered with coarse gravel which doubtless helps to retain them in place and affords protection from certain kinds of enemies. At about two years they pass down to the sea. Here they may stay until maturity is reached (in the fourth year) or may run up-stream when still immature when those of a year earlier make their ascent. After spawning they may again return to the sea, spawning not necessarily being fatal to this species as it is to the Pacific coast salmons.

The food of the salmon in the sea consists chiefly of fishes and crustaceans.

A weight of 88 pounds is recorded for a British specimen although this is decidedly unusual; 83 pounds for American fish.

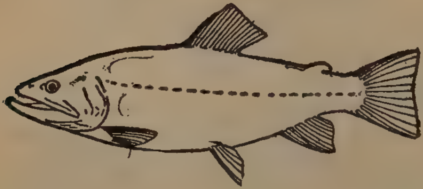
Rainbow Trout

Salmo irideus
Gibbons
Cf. LaMonte, PL. 46



This typically fresh water species originally brought to our coastal streams from California occasionally descends to estuaries. When in salt water it loses its well known characteristics to a great extent and becomes largely silvery, appearing much like our salmon.

Reaches a weight of 26½ pounds and a length of 42 inches.



Brook Trout

Salvelinus fontinalis (Mitchill)

LaMonte, Pl. 50

A distinctly fresh water species seldom descending to salt water. At Woods Hole, Massachusetts, they are reported as wintering in the shore waters at times.

Recorded to a weight of 14½ pounds.

The Smelts—*Family Argentinidæ*

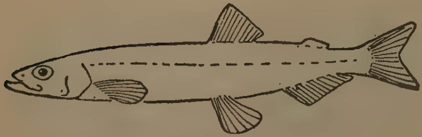
Body elongate, somewhat similar to the Salmonidæ, anatomical difference largely internal (see key).

A. Ventral fins inserted in front of middle of dorsal; mouth large.

B. Scales small; teeth feeble; pectoral fins broad, 15 to 20 rays. *Capelin*, 74.

BB. Scales large; teeth strong; pectoral fins moderate, 10 to 12 rays; vomer with 2 to 4 fang-like teeth. *Smelt*, 75.

AA. Ventral fins in back of middle of dorsal; mouth rather small; maxillary not reaching past front of eye. *Argentine*, 75.



Capelin

Mallotus villosus (Müller)

Occurs in Arctic Seas, rarely south to Maine and possibly to Cape Cod.

Feeds largely on small crustaceans.

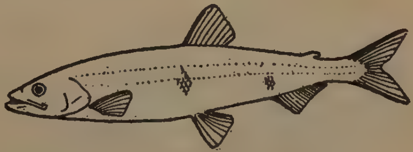
Spawns in salt water (not anadramous). The eggs are heavy, adhesive, reddish in color and are about 1.0 mm. in diameter. They are usually deposited on sandy shores from low tide to 40 fathoms.

Reaches a maximum size of 7½ inches.

Smelt

Osmerus mordax
(Mitchill)

LaMonte, PL. 67



Known from the Gulf of St. Lawrence to Virginia.

Smelt enter fresh or brackish water in the late winter or early spring for the purpose of spawning. The eggs are heavy and adhesive and average about .05 mm. in diameter. A two-ounce fish may deposit up to about 50,000 eggs. After spawning they return to the sea and move offshore just far enough to find waters cool enough to suit them.

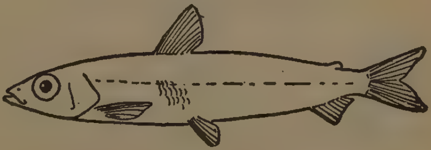
They are active and have mouths well equipped with teeth and feed freely on smaller fishes, swimming crustacea, etc.

Although of very small size for a food fish they are highly esteemed and fished for to the point of destruction. Even for commercial purposes they are usually taken by hook and line. Formerly in places they appeared in such compact and large schools that they could be dipped out of the water in quantities by means of pots or pans. Various land-locked forms in our northern lakes have naturally suffered more from overfishing than those that gain a respite by resorting to the sea.

Adults may average about 8 inches with records reaching up to 14.

Argentine

Argentina silus
Ascanius



Occurs in the north Atlantic usually in deep water, down to 300 fathoms south on our coast to Maine.

They will take fish or mussels on a baited line.

Spawns in late spring and summer. The eggs are scarcely buoyant, seldom coming to the surface, are non-adhesive and average 3.25 mm. in diameter.

Reaches a length of 18 inches.

THE LANTERN FISHES—*Order Iniomi*

Body oblong or elongate, little compressed, cycloid scales, sometimes naked, mouth wide, adipose fin usually present, ventrals usually present, sometimes longer or even larger than pectorals, sides sometimes with luminescent spots. Mostly deep sea fishes with a few pelagic and shore representatives and a few stragglers from deep oceanic waters occasionally reaching our shores.

A. Ventral fins larger than pectorals, nearly under them, no luminous organs, dorsal short, adipose fin and scales present. *The Lizard Fishes*, 76.

AA. Ventral fins smaller than pectorals, well back from them.

B. Luminous spots (photophores) well developed.

C. Body covered with well developed scales, premaxillaries forming entire margin of upper jaw. *The Lantern Fishes*, 78.

CC. Body covered with very weak caudaceous scales, maxillaries forming part of margin of upper jaw. *The Pearl Sides*, 78.

BB. Luminous spots weak or absent.

D. Dorsal long, occupying all of back, no scales. *The Lancet Fishes*, 78.

DD. Dorsal short, posterior, thin scales present. *The Scaled Lancet Fishes*, 79.

The Lizard Fishes—*Family Synodontidæ*

Body elongate, little compressed, covered with cycloid scales, mouth very wide, no barbels, ventrals close behind pectorals and large, jaws well armed with teeth, adipose fin and lateral line present.

A. Vent slightly nearer base of caudal than axil of pectoral; head short, blunt, compressed. *Snake-fish*, 77.

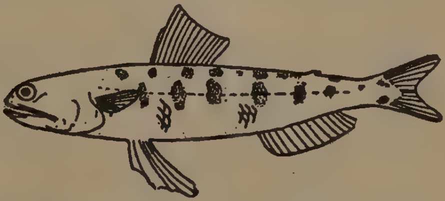
AA. Vent much nearer base of caudal than base of ventrals; head depressed, with flat triangular snout.

B. Scales large, 48; dorsal and anal each with 11 rays; spotted with orange. *Sand-diver*, 77.

BB. Scales small, 60 to 64, dorsal 9 or 10 and anal 11 to 12 rays, olive or brownish with pale yellow vermiculations. *Lizard-fish*, 77.

Snake-fish

Trachinocephalus myops (Forster)

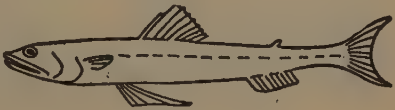


A typical West Indian form regularly ranging from South Carolina to Brazil. As a straggler it reaches Massachusetts.

Reaches about 9 inches in length.

Sand-diver

Synodus intermedius (Agassiz)



Known from North Carolina to Brazil.

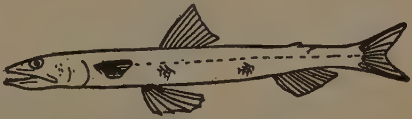
Fairly common. Its habits are similar to those of the more widely ranging lizard fish.

Feeds on fishes and crustaceans.

Reaches a length of about 15 inches.

Lizard Fish

Snyodus fœtens (Linnæus)



Known from Cape Cod to Brazil but rare north of South Carolina.

This species is a fish of sandy bottoms and as it rests on its expanded ventral fins or darts after small prey it resembles an overgrown fresh water darter (*Ethostomadæ*) both in color and actions to a considerable extent, although, of course, in the latter it is the pectoral fins which are enlarged.

Feeds largely on fishes.

Reaches a length of about a foot.

The Lantern Fishes—*Family Myctophidæ*

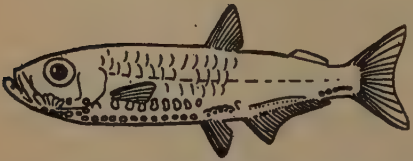
Deep sea and pelagic fishes rarely touching our territories with the body oblong or moderately elongate. Luminous organs on head and body, adipose fin present.

Lantern Fish *Lampanyctus lacerta* (Goode & Bean)

Normally none of this family comes within our range although as an accident it is possible for a considerable number of the more pelagic types to appear from time to time especially of the more common ones such as the present.

Gulf Stream at moderate depths. Does not exceed 4 inches in length.

The Pearl Sides—*Family Maurolicidæ*



Pearl Sides
Maurolicus pennanti
(Walbaum)

A fish of the open seas occurring shoreward only accidentally. Its appearance is very likely associated with storms or submarine disturbances. The entire offshore fauna represents fishes that might at any time be intruded into our shore fauna, but how well they are protected from such accident is evidenced by the fact that this species is the only one of this family of which we have record.

Reaches a length of two or three inches.

The Lancet Fishes—*Family Alephsauridæ*

Deep sea fishes, well marked, of which one species may accidentally reach our waters at times. Scaleless fish with a long high dorsal of over 40 rays.

Lancet Fish *Alepisaurus ferox* Lowe

Deep waters of the Atlantic off the coasts of Nova Scotia and Massachusetts and the Grand Banks.

Reaches a length of about 3 feet.

The Scaled Lancet Fishes—*Family Paralepididæ*

Deep sea fishes scarcely, if ever, reaching our shores. They may be recognized by their short posterior dorsal fin, the presence of scales and their somewhat barracuda-like form.

Scaled Lancet Fish *Arctozenus borealis* (Reinhardt)

Greenland, occasionally south to Cape Ann and possibly further. A rare fish.

THE PIKE-LIKE FISHES—*Order Haplomi*

This order is properly represented in our region only by a single large family of small fishes. The exception to this is the occasional entrance of the fresh water pickerels into tide water.

A. Head long; mouth large and terminal deep cleft; body long; tail forked. *The Pickerels*, 79.

AA. Head short; mouth small and usually superior; body short; tail rounded. *The Killifishes*, 80.

The Pickerels—*Family Esocidæ*

Elongate fresh water fishes rarely descending to brackish water. They may be recognized by their long mouths and general "barracuda-like" appearance and the backward placement of the short dorsal and anal.

A. Branched dorsal rays 13 or 14; anal 12 or 13; branchiostegals 14 to 16; scales 122 to 126; adults with numerous more or less horizontal lines on sides forming reticulations; anal and paired fins usually pale. *Chain Pickerel*, 79.

AA. Branched dorsal rays 11 or 12; anal 11 or 12; branchiostegals 11 to 13; scales about 105; sides with usually over 20 more or less distinct dark vertical bars; no reticulations; anal and paired fins usually orange. *Grass Pickerel*, 80.

Chain Pickerel *Esox reticulatus* (Le Sueur)

Fresh waters of the Atlantic seaboard from Maine to Florida. Due to the agency of man now extended northward to New Brunswick. Rarely taken in the brackish effluents of Chesapeake Bay.

Reaches a length of about 2 feet. There is an exceptional record of one reaching 9 pounds.

Grass Pickerel *Esox americanus* Gmelin

Fresh coastwise waters from Vermont to Alabama. Rarely descends to brackish water about Chesapeake Bay, and probably on Long Island, New York.

[illegible], Fr. 54

Reaches a length of about 12 inches.

The Killifishes—*Family Pœciliidæ*

Body oblong or moderately elongated, compressed behind, depressed forward, covered with large cycloid scales. Lateral line very imperfect or usually entirely absent. Mouth terminal or superior. Head scaled above. Dorsal single. Some species give birth to living young (viviparous). In these the male's anal fin is modified into an intromittent organ and internal fertilization takes place.

A. Anal fin of male similar to that of female (species oviparous.)
B. Teeth all pointed.
C. Teeth in villiform bands or at least more than 1 series.
D. Gill opening not restricted above, body oblong.
E. Dorsal inserted over or before anal; 11 to 17 rays.
F. Dorsal inserted before anal; branchiostegals 5 or 6.
G. Scales 31 to 38.
H. Scales 31 to 34, body depth 4 to 4½, dorsal rays usually 12, anal rays 9 to 11, body with 10 to 15 narrow dark vertical bars.
I. Snout shorter than eye, a black spot before dorsal. *Pale Killifish*, 82.
II. Snout 1½ times eye, no black spot before dorsal (male with an ocellate dorsal spot). *Gulf Killifish*, 82.
HH. Scales 35 to 38, anal rays 10 to 12; dorsal rays, body depth 3¾ to 4.
J. Female with 2 or 3 black horizontal stripes; male with about 12 dark crossbars and a dorsal ocellus; head 3¾, branchiostegals 6. *Striped Killifish*, 82.
JJ. Female plain or with dark crossbars only, no horizontal stripes; branchiostegals 5, dorsal rays 10 or 11.

K. Form robust, depth 3⅔, head 3⅔, male with pearly spots, females nearly plain. *Common Killifish*, 83.

KK. Form rather slender, depth 4, head 3¼, dorsal ocellus on female very conspicuous and banded or spotted. *Ocellated Killifish*, 83.

GG. Scales 44 to 60, dorsal 13 to 15, anal 11 to 14, depth 4⅔ to 5, numerous crossbars. *Fresh-water Killifish*, 84.

FF. Dorsal over or slightly behind anal, branchiostegals 4 or 5, scales 35, dorsal 10, depth 3¾, rows of scales of upper parts with longitudinal lines, about 14 pink crossbars. *Texas Killifish*, 84.

EE. Dorsal distinctly behind anal, 7 to 11 rays, anal 8 to 13 rays.

L. Scales 33, dorsal 8 or 9, body with fine specks which cluster together on sides forming irregular scattered round black spots. *Jenkins' Killifish*, 84.

LL. Scales 35, dorsal 8, male with a jet black ocellus on dorsal fin and rays 10, sides of both sexes with 10 to 12 black crossbars. *Lucy's Killifish*, 84.

DD. Gill openings restricted, adnate over a level with upper root of pectoral, depth 2 to 2½, 10 to 14 narrow pearly bands, scales 25. *Banded Killifish*, 84.

CC. Teeth arranged in a single series, mouth oblique, dorsal in advance of anal, both with 9 to 10 rays.

M. Depth 3½ to 3¾, dorsal 11 or 12, anal 9 to 10. *Pretty Killifish*, 85.

MM. Depth 3¼, dorsal and anal each 10. *Rain-water Fish*, 85.

BB. Teeth incisor-like, notched bi- or tri-cuspid, body deep, dorsal with 10 to 12 rays.

N. Head 3½, dorsal 11, anal 10, males with back largely blue, the lower parts coppery; females nearly black and white. *Broad Killifish*, 85.

NN. Head 3, dorsal 11, anal 9, males with faint copperly bars and yellow spots, fins tipped with orange, females with oblong blotches of bright orange. *Carp Killifish*, 86.

AA. Anal fin of male modified into a lancet-like intromittent organ and displaced forward (species viviparous).

O. Dorsal fin short, 6 to 9 rays, anal short, depth 3⅔ to 4, scales 30 to 32. *Top Minnow*, 86.

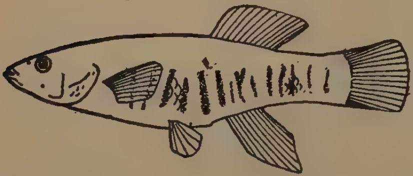
OO. Dorsal fin long and high, 13 to 16 rays, anal 8, depth 2½ to 3, scales 26. *Sail-finned Killifish*, 86.

Pale Killifish *Fundulus pallidus* Evermann

Known from Galveston Bay, Texas. Very rare.

Gulf Killifish *Fundulus similis* (Baird and Girard)

Known from the Gulf States from Florida to Texas.
Abundant in brackish water and shallow inlets.
Reaches a length of about 6 inches.



Striped Killifish
Fundulus majalis
(Walbaum)

Known from Cape Cod to Florida, becoming less common southward.

This is our largest killifish of the north. It is found typically in bays and marshes usually in company with the common killifish. Although both species are to be found in schools of varying size and density there are always scattered individuals to be seen poking about in beds of eel grass or rubbish piles.

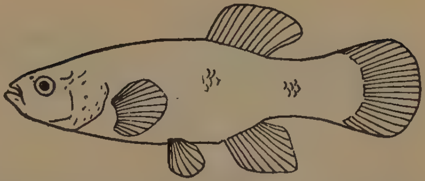
They are omnivorous, feeding on all manner of organic substances.

This species is one of our few northern forms in which the sexes are strongly marked. The male (figured herewith) has short transverse bars while the female has typically 3 or 4 longitudinal dark lines. During the spawning season the males take on bright colors, chiefly yellowish on the fins accompanied by a bold dark mark on the side of the head. The eggs are large, (about 2.16 mm. in diameter), deep amber in color and slightly adhesive. They are laid close to the shore line and generally are buried in sand. The egg does not hatch until the young fish has reached a stage of development where it looks essentially like its parents with its full complement of fins and is quite able to care for itself.

Reaches a length of 8 inches on occasion, but usually not over 5.

Common Killifish

Fundulus heteroclitus (Linnæus)



Known from the Gulf of St. Lawrence to the Gulf of Mexico. Three geographical races are differentiated. *F. h. macrolepidous* (Walbaum) ranges from the Gulf of St. Lawrence to about Virginia, *F. h. heteraclitus* (Linnæus) from there to Florida, and *F. h. grandis* (Baird & Girard) from Florida to Texas.

Progressing southward the most prominent difference is an increase in average size and brilliance of coloration.

An abundant form common in weedy places close to shore. It is exceedingly hardy, surviving in water that would be fatal to most fishes. Its ability to survive changes in temperature and salinity is remarkable. It is of considerable benefit to man because of its natural activity in destroying the larvæ of the salt marsh mosquito, although its feeding habits are entirely omnivorous.

This species is supposed to retire to deeper water in winter, although it can frequently be taken in a state of semi-hibernation in pools in salt marshes in cold weather.

Spawning takes place in weedy places usually of low salinity in spring (for *F. h. macrolepidotus*, at least). The males take on strikingly brilliant colors, being shot with orange and bluish reflections. The eggs average 1.97 mm. diameter, are spherical, amber in color and slightly adhesive. As with other species of this family the incubation period is long and the young are well developed when hatched.

F. h. macrolepidotus and *heteroclitus* reach a length of 5 inches, while *F. h. grandis* reaches 6.

Ocellated Killifish *Fundulus ocellaris* Jordan & Gilbert

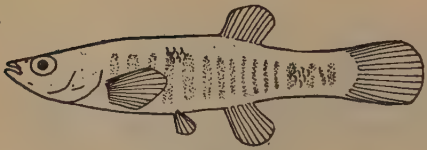
Known from Chesapeake Bay to Louisiana.

Fairly common on the Gulf coast but rare on the Atlantic. Quite variable in coloration.

Spawns in summer.

A rather omnivorous feeder.

Reaches a length of about 3 inches.



Fresh-water Killifish

Fundulus diaphanus
(Le Sueur)

This fresh-water species which occurs in coastwise streams and lakes from Maine to Cape Hatteras is occasionally taken in brackish water about the mouths of streams.

Reaches a length of 4 or 5 inches.

Texas Killifish *Fundulus funduloides* (Evermann)

A rare species, known from the coast of Texas.

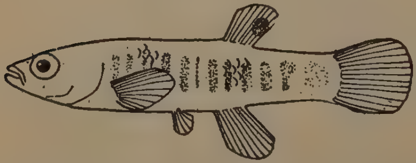
Reaches a length of 1½ inches.

Jenkins' Killifish *Fundulus jenkinsi* (Evermann)

Known from the Texas coast.

Fairly common in brackish water.

Reaches a length of about 4 inches.



Lucy's Killifish

Fundulus luciæ
(Baird)

A rare but attractive small killy known from Long Island to Virginia.

Spawns in summer.

Feeding habits similar to those of the common killifish.

Like most species of this genus it will live fairly well in fresh water.

Banded Killifish *Adinia multifasciata* Girard

Gulf coast from Florida to Texas.

Locally abundant in shallow inlets.

A rather handsome species, with brilliant colors.

Reaches a length of 2 inches.

Pretty Killifish *Lucania venusta* Girard

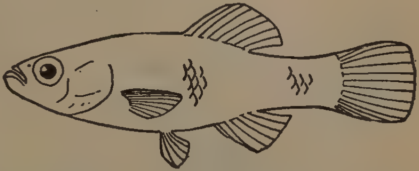
Gulf of Mexico, abundant at Pensacola, extending to Mexico.

A handsomely-colored small fish of inlets and lagoons.

Reaches a length of about 2 inches.

Rain-water Fish

Lucania parva
(Baird & Girard)



Known from Connecticut to Key West usually in brackish waters, although southward it is typically found in undiluted sea water. Not rarely found in fresh or nearly fresh water. Like many of this family its toleration of salinity variation is large. It is locally common, that is, a small area will often form the habitat of a large group when adjacent miles of similar appearing shore line will not yield a single example.

Spawns in early spring and the eggs incubate in about 2 weeks.

Feeds largely on small crustacea.

Reaches a length of slightly over 2 inches.

Broad Killifish

Cyprinodon variegatus
Lacépède

Known from Cape Cod to Texas. Represented in Florida and Cuba by a race *C. v. riverendi* (Poey) which has slightly larger scales and the anal black edged.

During the spawning season (which is long, although at its height in late spring in the latitude of New York) the males take on very brilliant colors, chiefly steel blue above and orange below. When in this condition they equal many tropical reef fishes in brilliance.

The eggs are not laid all at one time, a few being deposited daily for some time or a number may be laid at a time with longer intervals between. They are spherical, yellowish, and average about 1.3 mm. in diameter. They are heavier than sea water and because of the possession of numerous adhesive threads adhere to each other and any object with which they come in contact. They hatch in from 5 to 6 days at a temperature of about 60° F. By 5 days the yolk sac is absorbed. At the size of 10 mm. most of adult diagnostic characters are acquired. Maturity is reached in a year.

The food consists largely of vegetable matter.

Reaches a length of about 3 inches.

Carp Killifish *Cyprinodon carpio* Gunther

Coast of southern Florida.
Reaches a length of 3 inches.

Top Minnow *Gambusia holbrooki* (Baird & Girard)

South Atlantic and Gulf Coasts straggling north to Delaware and very rarely to New Jersey.

Locally abundant in marshes and lagoons both in fresh and brackish water.

This species has been used extensively in the work of mosquito control. Because of their permanent small size it has proven especially valuable in seeking out the larval mosquitoes inaccessible to larger species. Its great fecundity has more than offset its diminutive stature. It is viviparous, the young being released when about ⅓ of an inch long. In an aquarium, at least, the males, which are always smaller than their mates, fight pugnaciously often with fatal results.

A form of uncertain status in which the male is irregularly marked with prominent black spots is almost exclusively found in fresh water.

The females, which are always much more numerous than the males, may reach as much as 2 inches but the males do not exceed 1 inch.

Sail-finned Killifish *Mollienisia latipinna* Le Sueur

Known from South Carolina to Mexico.
Found in fresh, brackish and sea water. Very common.

The male possesses an exquisitely colored dorsal fin of immense size which it spreads and displays in the presence of females not unlike a peacock in general effect. The dorsal of the female is much smaller and less brilliant.

Like the top minnow it is viviparous but is neither as quarrelsome or prolific.

Reaches a length of about 3 inches.

THE SYNENTOGNATHOUS FISHES—*Order Synentognathi*

Usually rather elongate fishes or if not elongate are provided with enlarged pectoral and sometimes enlarged ventral fins which enable them to "fly". The fins are without true spines and the lateral line is concurrent with the ventral outline. The lower jaw or both may be exceedingly long but is usually short in most of the flying forms. The lower lobe of the caudal fin is usually of a considerably greater length than the upper.

A. Both jaws produced into a long toothed beak in adult (the upper is shorter in the young), scales small. *The Needlefishes*, 87.

AA. Both jaws not produced into a long toothed beak unless the dorsal and anal is followed by mackerel-like finlets.

B. Pectorals not produced into "wings" for flight.

C. Lower jaw usually produced into a long process,[1] the upper short; dorsal and anal not followed by finlets. *The Halfbeaks*, 90.

CC. Both jaws somewhat produced and the dorsal and anal followed by mackerel-like finlets. *The Sauries*, 92.

BB. Pectorals greatly enlarged, functioning as wings for flight. *The Flying Fishes*. 92.

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[1] A single form, the hardhead, lacks this process and resembles the silversides, but of course, lacks a spinous dorsal.

The Needlefishes—*Family Belonidæ*

Elongate fishes with both upper and lower jaw produced into a long toothed beak and lacking finlets after the dorsal and anal fins.

A. Body subquadrate, its breadth more than ⅔ its greatest depth.

B. Caudal peduncle compressed, deeper than broad, without trace of a keel along lateral line, dorsal and anal 13 to 15 rays each, posterior rays not elevated, anal larger than dorsal and inserted farther forward, jaws nearly twice rest of head.

C. Scales large, about 85 predorsal; body robust, depth about 5 in head, tips of dorsal, anal and caudal brick red, lateral stripe narrow for entire length, dorsal and anal rays 13 each, lateral line 150. *Needlefish*, 88.

CC. Scales small, about 140 or 150 predorsal; body slender, depth about 7 in head; fins not red; lateral stripe broadened under dorsal fin, dorsal 15, anal 17 rays, lateral line 225. *Timucu*, 88.

BB. Caudal peduncle somewhat depressed, with an evident keel on the lateral line, dorsal and anal 15 to 23 rays.

D. Dorsal rays 15, anal 17, lateral line 300, a dark bar on opercle, ventrals inserted midway between opercle and base of caudal. *Billfish*, 88.

DD. Dorsal and anal rays 1, 17 to 25 each, ventrals inserted midway between base of caudal and middle of eye, no distinct lateral stripe.

E. Beak short and strong, 1½ to 1⅚ times rest of head; depth more than ⅕ head, dorsal rays 1, 21 to 24, anal rays 1, 22 to 24, lateral line 350, dorsal almost opposite anal. *Houndfish*, 89.

EE. Beak longer, about twice rest of head, dorsal in front of anal, dorsal rays 1, 23, anal 1, 21, lateral line 380. *Agujon*, 89.

AA. Body much compressed, its breadth not half its greatest depth, dorsal 25, anal 27, scales about 520. *Flat Needlefish*, 89.

Needlefish *Strongylura notatus* (Poey)

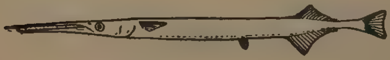
Florida, common about the Keys, north on the West Coast to Pensacola. Pale greenish with a silvery stripe.

Reaches a length of about 20 inches.

Timucu *Strongylura timucu* (Walbaum)

Not uncommon about the Florida Keys, but ranges generally south of our region.

Reaches a length of about 18 inches.



Billfish
Strongylura marinus
(Walbaum)

Known from Maine to Texas, but not common north of Cape Cod. Frequently ascends rivers to considerable distances.

Like most of these fishes this species thrusts itself up through the surface of the water in a spear-like manner. It is a voracious feeder and preys mostly on small fishes such as the silversides.

Its eggs are provided with tufts of long threads so that they entangle with each other or any object with which they come in contact, remaining in compact masses. So far as known, this is true of all the fishes of this group.

A length of 4 feet is attained by this species, but generally they are much short of this.

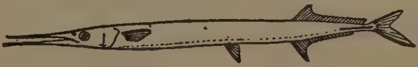
Houndfish *Strongylura raphidoma* (Ranzani)

This species may be recognized by its unusually short and strong beak. It is fairly common as far north as Florida, and the young have been recorded as far north as New Jersey.

This species also has the habit of leaping in a spear-like manner and in common with other large species is, to a certain extent, a hazard to persons in small boats in the tropics, records not being particularly rare of fishermen being wounded more or less severely by the accidental thrusts of these living javelins.

It attains the length of 5 feet on occasion.

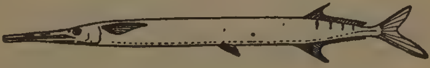
Agujon
Strongylura acus
(Lacépède)



A widely distributed form known from the Mediterranean as well as our coast. It sometimes strays as far north as Massachusetts.

It reaches a length of 4 feet.

Flat Needlefish
Ablennes hians
(Cuvier & Valenciennes)



This species differs from all the preceding in being well flattened from side to side.

It is not uncommon about Florida and strays northward to Massachusetts.

It, too, reaches a large size, records running up to 3 feet.

The Halfbeaks—*Family Hemirhamphidæ*

Fishes somewhat similar in appearance to the Needlefishes, but with less elongate bodies and only the lower jaw produced, which is toothless beyond the reach of the upper jaw in our species. In the Hardhead (*Chriodorus*) the lower jaw is not produced but this form may be recognized by the low lateral line following the ventral outline which is characteristic of the group.

A. Lower jaw blunt, not produced, teeth large; pectorals and ventrals moderate. *Hardhead*, 90.
AA. Lower jaw acute, larger than upper, produced into a long pointed beak, teeth comparatively small.
B. Body moderately compressed, pectorals moderate.
C. Ventrals inserted far in advance of dorsal, body somewhat convex, air bladder simple.
D. Gill-rakers 21, dorsal 15, anal 16. *Halfbeak*, 91.
DD. Gill-rakers 29, dorsal 14, anal 15. *Pajarito*, 91.
CC. Ventrals inserted scarcely in advance of dorsal, body flattened, the sides nearly parallel and vertical, air bladder cellular. *Balao*, 91.
BB. Body very slender and compressed, band-like, pectoral fins long, ventrals short, inserted posteriorly. *Flying Halfbeak*, 91.

Hardhead *Chriodorus atherinoides* Goode & Bean

A curious halfbeak that lacks the character which normally marks the group. Otherwise very similar to its relatives although superficially it resembles the silversides. From these it may at once be distinguished by the possession of one dorsal fin instead of two and the low lateral line. A strong lateral silvery band adds to the illusion.

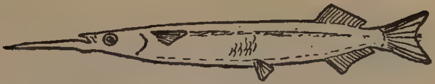
As is customary in this family it is largely a vegetarian and is reputed to be an excellent food fish.

Common about the Florida Keys.

Reaches a length of 10 inches.

Halfbeak

Hyporhamphus unifasciatus (Ranzani)



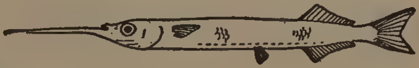
West Indies, straying northward to Massachusetts.

There has been considerable confusion between this form and *H. hildebrandi* Jordan & Evermann. The latter ranges further south, but may be expected to be taken on our more northerly shores via the Gulf Stream. Probably most, if not all, of these records refer to *H. unifasciatus* instead of *H. hildebrandi*. However, the two may be readily separated by counting the gill-rakers, as indicated in the key.

The present form reaches about a foot in length.

Pajarito

Hyporhamphus hildebrandi Jordan & Evermann



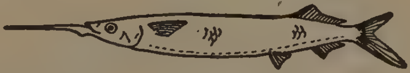
See the above for discussion. Known from both coasts of tropical America.

Both these forms are good food fishes.

Reaches about a foot in length.

Balao

Hemiramphus brasiliensis (Linnæus)



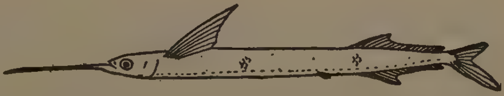
A common West Indian form, reaching Florida and as a straggler north to Massachusetts.

Vegetarian to a considerable extent.

Reaches a length of about 15 inches. A characteristic mark in life is the orange-red color of the upper caudal lobe.

Flying Halfbeak

Euleptorhamphus velox (Poey)



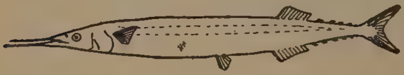
An oddly formed species with large pectorals. Occurs in the West Indies, drifting northward on our shores as far as Massachusetts occasionally.

The leaping behavior of this species is said to approach that of the flying fishes.

Reaches a length of about 2 feet.

The Sauries—*Family Scomberesocidæ*

In our single form both jaws are produced to form a rather short beak similar to that of the billfishes. Both the dorsal and anal are followed by a series of mackerel-like finlets.



Skipper

Scomberesox saurus
(Walbaum)

A fish of the open seas, living in great schools. It comes to the seaside naturalist's attention chiefly when stranded, presumably after having been chased ashore by predacious enemies such as bluefish. It leaps out of water frequently, supposedly for this same reason.

It spawns in the open sea between 11° and 40° north latitude. The prolonged jaws do not begin to develop until a length of an inch and a half is reached. The lower jaw grows faster than the upper so that when between four and six inches long they look somewhat like halfbeaks.

Occurs off shore on both coasts of the temperate Atlantic.

A length of 30 inches is recorded, but over 18 is unusual.

The Flying Fishes—*Family Exocœtidæ*

Fishes with greatly enlarged pectoral fins capable of sustaining them in more or less prolonged flight. In most forms the ventrals also serve as planes. The snout is blunt and the lower caudal lobe much longer than the upper. This lower lobe functions in rising from the surface of the water and in skittering over it. Primarily fishes of tropical seas occasionally wandering northward into our more temperate waters.

A. Vomer, palatines, pterygoids and tongue with teeth; pectoral fins moderate, not reaching beyond middle of dorsal fin, dorsal base less than dorsal height; anal base scarcely shorter than dorsal base.
Short-winged Flyingfish, 95.

AA. Vomer, palatines, pterygoids and tongue usually toothless (sometimes a few on vomer or palatines); pectoral fins long, always reaching beyond middle of dorsal, usually to base of caudal; dorsal base greater than dorsal height.

B. Ventral fins inserted before middle of body, much nearer tip of snout than base of caudal, small, not nearly reaching front of anal.

C. Dorsal origin in front of anal; distance from snout to ventrals greater than from ventrals to last dorsal ray, young with a barbel on chin. *Caribbean Flyingfish*, 95.

CC. Dorsal origin behind front of anal; distance from snout to ventrals less than from ventrals to last dorsal ray, no barbels at any size. *Two-winged Flyingfish*, 95.

BB. Ventral fins inserted after middle of body, nearer base of caudal than tip of snout, large, reaching at least to middle of anal and usually to its end.

D. Anal fin long, its base a little less than that of dorsal, its first ray nearly opposite first ray of dorsal; anal rays 11 or 12.

E. Second pectoral ray simple; third divided; fourth and fifth longest. *Black-winged Flyingfish*, 95.

EE. Second pectoral ray divided; third and fourth largest. *Four-winged Flyingfish*, 96.

DD. Anal fin short, its base ½ to ⅔ length of base of dorsal, its insertion behind first ray of dorsal, anal rays 9 to 10.

F. Second pectoral ray simple; third divided, fourth and fifth largest, muzzle broad and short. *Blunt-nosed Flyingfish*, 96.

FF. Second pectoral ray divided; third and fourth largest; muzzle not especially broad and short.

G. Ventral fins inserted about midway between pupil and base of caudal.

H. Dorsal and anal without black markings, ventrals pale. *Atlantic Flyingfish*, 96.

HH. Dorsal and anal marked with black, ventrals black with pale edgings and a white spot near the base. *Spot-fin Flyingfish*, 96.

GG. Ventral fins inserted about midway between middle of cheek and base of caudal, dorsal dusky; anal pale, slightly dusky distally, ventrals nearly uniformly dusky. *Monroe's Flyingfish*, 97.

FIELD KEY TO ADULT FLYINGFISHES

(Based largely on wing pattern)

As most often members of this family are seen on the wing, as from the prow of a vessel, the following key is given with the hope of aiding a student to name such specimens as may be so seen. It, of course, must be used with caution, especially near the limits of our range, as it is practically impossible to set definite boundary limits for such wide ranging oceanic forms as flying fishes.

A. Two wings only evident in flight.

B. Very dusky, with a light area on posterior edge; darkest at anterior edge. *Caribbean Flyingfish*, 95.

BB. Wings clear, with a dark spot on the anterior edge and a band near the distal edge, widest anteriorly, tapering to a point near the posterior edge. *Two-winged Flyingfish*, 95.

AA. Four wings evident in flight.

C. Pectorals without distinct pattern.

D. Pectorals transparent or very light.

E. Ventrals transparent or sometimes reddish on anterior edge, pectorals very light dusky, (usually all fins appear transparent in flight). *Short-winged Flyingfish*, 95.

EE. Ventrals dusky, darkest at tip and lightest at base, pectorals light dusky. *Blunt-nosed Flyingfish*, 96.

F. Ventrals uniform dusky, pectorals dusky, darkest medially and with a vague transparent edging to posterior edge. *Monroe's Flyingfish*, 97.

FF. Ventrals darkest medially, with a light axil and a light tip; pectorals uniform dusky except for a scarcely evident distal edging of transparent. *Black-winged Flyingfish*, 95.

CC. Pectorals with a distinct and sharply defined pattern of black and transparent.

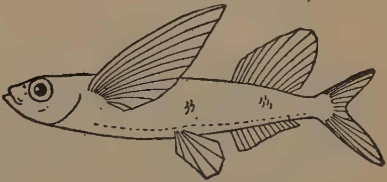
G. Pectorals dark with a broad transparent band running diagonally entirely across fin.

H. Ventrals dark with a broad white band similar to pectorals, scarcely evident distal edging of transparent also on pectorals. *Spot-winged Flyingfish*, 96.

HH. Ventrals transparent except for a dark axil, pectoral tip also transparent. *Atlantic Flyingfish*, 96.

GG. Pectoral uniform dusky except for transparent bar which reaches about ¾ way across fin and a very narrow transparent edging.
Four-winged Flyingfish, 96.

Short-winged Flyingfish
Parexocœtus mesogoster
(Bloch)



Cosmopolitan in warm seas, moving northward in the Gulf Stream. The most common species from Hatteras to Florida, in the Gulf Stream. Straggles north to Rhode Island.

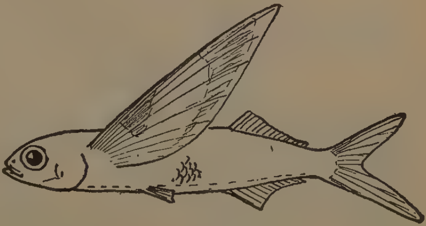
A small species reaching a length of 7 inches or possibly over.

Caribbean Flyingfish *Halocypselus evolans* (Linnæus)

Known from the West Indies and the Pacific coast reaching north to Florida in the Atlantic. Not very common.

Reaches a length of about 7 inches.

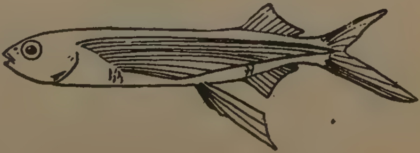
Two-winged Flyingfish
Halocypselus obtuserostris
(Günther)



Known from the West Indies and the Pacific coast, reaching north to Florida. Not very common.

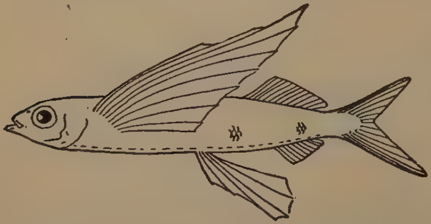
Reaches a length of about 7 inches.

Black-winged Flyingfish
Exonautes rondeletii
(Cuvier & Valenciennes)



Cosmopolitan in warm seas, north to Florida; questionably north to Massachusetts. Sometimes common where found and capable of flights of at least an eighth of a mile.

Reaches a length of 11 inches or more.

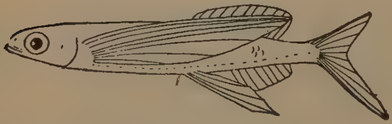


Four-winged Flyingfish
Hirundichthys affinis
(Günther)

Occurs in warm seas reaching northward in the Gulf Stream.

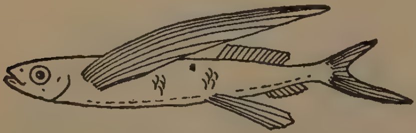
Often occurs in large schools.

Reaches a length of 12 inches exceptionally.



Blunt-nosed Flyingfish
Prognichthys gibbifrons
(Cuvier & Valenciennes)

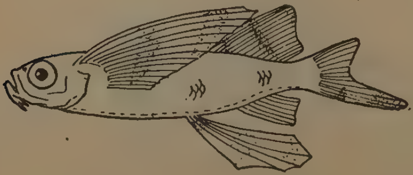
A rare species known from two specimens, one from Rhode Island.



Atlantic Flyingfish
Cypselurus heterurus
(Rafinsque)

Known chiefly from the warmer parts of the Atlantic, straying northward to the Newfoundland banks and on the east coast to England.

Reaches a length of 15 inches.



Spot-fin Flyingfish
Cypselurus furcatus
(Mitchill)

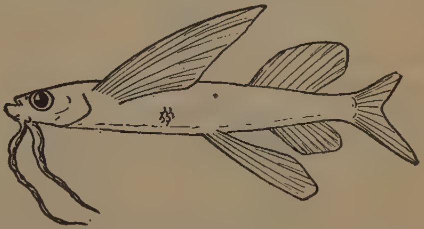
Known from the warmer parts of the Atlantic, straying north to Cape Cod.

Up to a size of 3¼ inches they have a variegated pattern of black, white and yellowish, and occur in drifting weed which they may somewhat resemble because of this pattern.

Reaches a length of 6 inches.

Monroe's Flyingfish

Cypselurus monroei (Nichols & Breder)



Known from a single specimen from Cocoanut Grove, Florida, about 2 inches long.

This is a very remarkable form characterized by the possession of two exceedingly long fleshy and fluted barbels in the chin, which are about half as long as the entire fish.

THE HEMIBRANCHS—*Order Hemibranchii*

Fishes usually protected by large plate-like scales. Distinguished mostly by internal anatomical details, although our species are all well marked from other types.

A. Dermal armature developed only as plates on sides or back; spinous dorsal represented by isolated spines.

B. Ventrals subthoracic, each with a strong sharp spine with less than 5 soft rays; dorsal spines strong; body not elongate. *The Sticklebacks*, 98.

BB. Ventrals subabdominal, near middle of body, without spines and with 5 or 6 soft rays.

C. Dorsal spines weak; body compressed, moderately long with ctenoid scales; no caudal filament. *The Trumpet Fishes*, 100.

CC. Dorsal spines undeveloped; body depressed or subcylindrical, very long, with no scales; caudal with middle rays produced into a long filament. *The Cornet Fishes*, 100.

AA. Dermal armature little developed, only anteriorly, especially about back; spinous dorsal developed. *The Snipe Fishes*, 100.

The Sticklebacks—*Family Gasterosteidæ*

Small fishes with a large sharp spine in each ventral fin, which has few soft rays, a very narrow caudal peduncle, isolated spines in advance of dorsal and usually some enlarged scales on the sides.

A. Dorsal spines 8 or 9; tail keeled but body nearly devoid of protective plates.
Ten-spined Stickleback, 98.

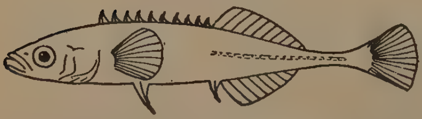
AA. Dorsal spines 4 or less.

B. Dorsal spines 2; sides of body more or less protected by large plates.

C. Ventral spine with a strong basal cusp on each side; ventral fin with 2 (rarely 1) soft rays.
Northern Stickleback, 98.

CC. Ventral spine without a strong basal cusp on each side; ventral fin with 1 or no soft rays.
Two-spined Stickleback, 99.

BB. Dorsal spines 4; no bony plates on sides.
Four-spined Stickleback, 99.



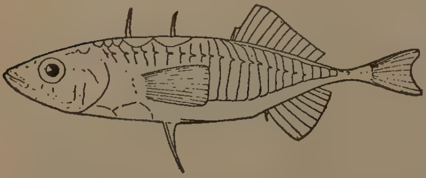
Ten-spined Stickleback

Pygosteus pungitius (Linnæus)

Circumpolar in fresh and brackish water, south to northern New Jersey on our coast.

Spawns early in spring. In common with other species of this family the male builds a nest in grass or weeds and guards the eggs until they hatch. They incubate in about 12 days and on hatching the larvæ are about 6 mm. long.

Reaches a length of 3 inches.



Northern Stickleback

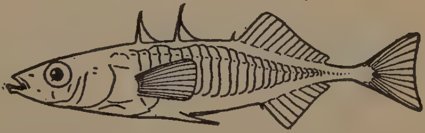
Gladiunculus wheatlandi (Putnam)

Known from Newfoundland to Massachusetts usually in a strictly marine environment.

Unlike our other sticklebacks this species leads a semi-pelagic existence for most part and has a rather restricted range.

Reaches a length of about 4 inches.

Two-spined Stickleback
Gasterosteus aculeatus
Linnæus



Circumpolar in distribution in brackish water for most part. South on our coast to New Jersey.

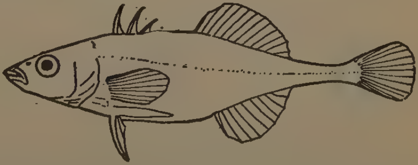
This species has been variously split into races or full species but the status is such that it would be unwise for our purposes to attempt to define any of these small racial or other differences that seem to be correlated chiefly with the effects of environment on the individual.

Feeds on fish, fish eggs, crustacea, et cetera, as well as on diatoms. Usually to be found in shallow water amid eel grass and seaweed.

During the spawning season, spring and early summer, the males assume brilliant nuptial colors and actively battle among themselves. They build a barrel- or muff-shaped nest which is cemented together by mucous threads (a secretion of the kidneys). One or more females are induced to deposit eggs in the nest which the male then attentively guards. They incubate in about 10 days. On hatching the male destroys the nest but continues to guard the young until they can shift for themselves. On hatching the young are about 4.5 mm. long and in six weeks reach about 15 mm. and closely resemble the adults.

They reach a length of 4 inches.

Four-spined Stickleback
Apeltes quadracus
(Mitchill)



Known from New Brunswick and Nova Scotia to Virginia but more common in the north of its range.

A salt water species entering brackish water or rarely fresh water.

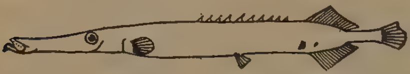
Feeds largely on copepods.

In the latitude of New York it spawns from May to July, usually in water somewhat brackish. The eggs are spherical, adhesive, heavy, yellowish in color and average about 1.6 mm. in diameter. They hatch in six days at a temperature of 72° F. The newly hatched larvæ are about 4.3 mm. in length. As with other species of sticklebacks the males construct an elaborate nest and guard the coming generation with care.

Reaches a length of 2½ inches, although over 1½ inches is unusual.

The Trumpet Fishes—*Family Aulostomidæ*

Elongate fishes of the tropics; one species in our range.



Trumpet Fish

Aulostomus maculatus Valenciennes

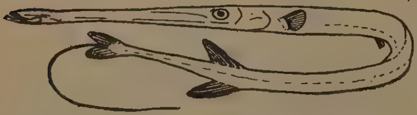
West Indies, north to southern Florida.

Feeds on small fishes.

Reaches a length of about 1 foot.

The Cornet Fishes—*Family Fistulariidæ*

Elongate tropical fishes readily distinguished from the preceding by the long central caudal filament.



Cornet Fish

Fistularia tabacaria Linnæus

A West Indian species, straggling northward as far as Massachusetts.

Reaches a length of 6 feet exclusive of the long caudal whisp. Those which drift northward on the Gulf Stream are usually less than a foot.

The Snipe Fishes—*Family Macrorhamphidæ*

An old world family accidental on our coast.

Snipe Fish *Macrorhamphosus scolopax* (Linnæus)

A Mediterranean species reaching north to England and accidental in the northern part of our range. Reddish in color. Reaches nearly a foot in length.

The Lophobranchs—*Order Lophobranchii*

Fishes covered more or less completely with bony plates. The snout is produced with a small mouth at its end. The gill opening is restricted to a small pore and the gills are composed of small rounded tufts. But one family.

They are all characterized by their curious mode of reproduction. The female by the aid of a long tube (ovipositor) places her eggs in a pouch on the abdomen of the male where they are fertilized. There they incubate and hatch and are protected somewhat as are the young of marsupial mammals until they are ready to shift for themselves.

The Pipefishes—*Family Syngnathidæ*

Characters covered above.

A. Tail not prehensile, usually with a distinct caudal fin, axis of head in line with axis of body.
B. Top of head with or without a slight carination, snout with or without keel, opercle without prominent ridge.
C. Dorsal moderate or long, its first ray in advance of vent; snout moderate or long; angles of body generally prominent.
D. Dorsal covering 1 or 2 body rings.
E. Dorsal covering 6 or 7 caudal rings; body rings 17 to 18; caudal rings 31 to 36; dorsal rays 27 to 32.
G. Snout moderate, 1⅔ to 2 in head, dorsal on 2 + 6 dorsal 29 to 32. *McKay's Pipefish*, 102.
GG. Snout long, 1⅓ in head; dorsal on 1 + 7 rings (rarely 2 + 6) dorsal 27. *Florida Pipefish*, 103.
EE. Dorsal covering 4 or 5 caudal rings.
F. Dorsal rays 26 to 28 on 1½ + 5 rings; rings 16 to 34. *Rousseau's Pipefish*, 103.

FF. Dorsal rays 24 or 25 on about 1 + 4 rings. *Poey's Pipefish*, 103.

DD. Dorsal covering 3 body and 4 to 6 caudal rings.

H. Caudal rings not more than 34.

I. Snout short, less than ½ head; dorsal high; rings 18 + 33; dorsal 35 on 5 + 4. *Gulf Pipefish*, 103.

II. Snout rather long, more than ½ head; rings 18 + 31 to 34, dorsal 30 to 34 on 3 + 5. *Scovell's Pipefish*, 103.

HH. Caudal rings not less than 36.

J. Rings 20 to 21 + 3 to 38; dorsal 32 to 37 on 3 + 5. *Louisiana Pipefish*, 103.

JJ. Rings 16 to 20 + 36 to 40; dorsal 36 to 40 on 5 + 4 or 4 + 5. *Northern Pipefish*, 103.

CC. Dorsal short, its first ray behind vent, snout short, ⅓ of head, angles of body little marked; dorsal 20 rings on 15 + 38 or 39. *Hairy Pipefish*, 104.

BB. Top of head strongly carinated, keel extending from interorbital space to first body ring, opercle with a prominent ridge, rings 18 + 30; dorsal rays 23 on 1 + 4 rings; snout white 2⅗ in head. *White-nosed Pipefish*, 104.

AA. Tail prehensile, no caudal fin, axis of head at an angle to that of body.

K. Dorsal fin large, 16 to 19 rays.

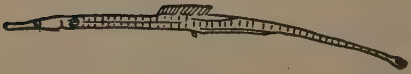
L. Dorsal fin with 19 rays, rings 11 + 32 to 35, depth of body equal to length of head, snout 2⅓ in head, body mottled. *Northern Sea Horse*, 104.

LL. Dorsal fin with 16 to 18 rays.

M. Dorsal 17 or 18 on 2 caudal rings, snout short, less than ½ head, light blue spots on head and snout. *Spotted Sea Horse*, 105.

MM. Dorsal 16 on 4 + 0 rings, snout longer than postocular part of head, body unspotted. *Southern Sea Horse*, 105.

KK. Dorsal fin small, 12 rays on 2 + 1 rings, snout very short, not more than ½ head. *Dwarf Sea Horse*, 105.



McKay's Pipefish

Syngnathus mackayi (Swain & Meek)

Gulf of Mexico from Florida to Yucatan. Rather common. Reaches a length of about 8 inches.

Florida Pipefish *Syngnathus floridæ* (Jordan & Gilbert)

Known from Chesapeake Bay to Texas. Fairly common. Reaches a length of about 7 inches.

Rousseau's Pipefish

Syngnathus rousseau Kaup

West Indies, north to Florida. Not common in our range. Reaches about 6 inches in length.

Poey's Pipefish

Syngnathus elucens Poey

Known from the West Indies north to Florida. Does not reach a large size.

Gulf Pipefish *Syngnathus affine* (Günther)

Gulf of Mexico, about Louisiana. Reaches about 5 inches in length.

Scovell's Pipefish *Syngnathus scovelli* (Evermann & Marsh)

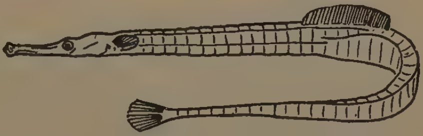
Gulf of Mexico, apparently rare. Reaches about 4½ inches in length.

Louisiana Pipefish *Syngnathus louisianæ* (Günther)

Virginia to Texas. Common and variable in characteristics. Reaches about 6 inches in length.

Northern Pipefish

Syngnathus fuscus Storer



Known from Halifax to North Carolina, most common in the latitude of New York.

Usually found in shallow water amid seaweed and debris, especially on sandy beaches, although has been taken as deep as 17 fathoms.

Feeds mostly on small crustaceans, such as *Gammarus*.

Spawns in late spring and early summer.

As with all members of the family the eggs are carried and hatched in a ventral broad pouch on the male in a manner not unlike the marsupials among mammals. The eggs are introduced into the male brood pouch by the long ovipositor of the female. After the young have reached a certain size they are expelled and left to shift for themselves.

Reaches a length of 12 inches, although over half that size is unusual.

Hairy Pipefish *Syngnathus crinigerum* (Bean & Dressel)

Southern Florida to Brazil. Not common in our range.

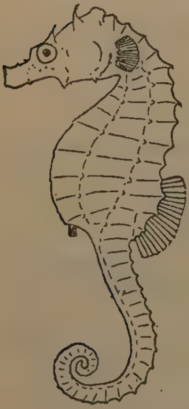
One of the smallest pipefishes, not reaching more than 3 inches in length.

White-nosed Pipefish *Syngnathus albirostre* (Heckel)

West Indies north to southern Florida.

Tends to live in deeper waters than most species.

Reaches a length of about 6 inches.



Northern Sea Horse
Hippocampus hudsonius De Kay

Known from Charleston to Cape Cod and rarely to Nova Scotia. Locally abundant but extremely variable in occurrence from year to year. Known chiefly as a summer fish. Where it goes or what it does in winter is unknown.

So far as known the sea horse feeds exclusively on tiny living organisms, uniformly refusing dead food in captivity.

The breeding habits are essentially similar to those of the pipefish, the male incubating the eggs in a ventral pouch. At the time of expulsion from the pouch the young average about 7 mm. in length. The rate of growth is unknown.

Reaches a length of about 5 inches, but recorded up to 7½ inches.

Spotted Sea Horse
Hippocampus punctulatus Guichenot

West Indies casually north to North Carolina and once recorded from New Jersey. Not common.

Reaches a length of about 5 inches.

Southern Sea Horse *Hippocampus stylifer* Jordan & Gilbert

Florida, usually in fairly deep water.

Reaches about 5 inches as a maximum.

Dwarf Sea Horse *Hippocampus zosteræ* Jordan & Gilbert

Known from Pensacola Bay where it is found usually in the shallow water of lagoons. Its close association with eel-grass (*Zostera marina*) accounts for its technical name.

The smallest sea horse known, not reaching over 2 inches in length.

THE SPINY-RAYED FISHES—*Order Acanthopteri*

The dominant group of fishes today. They are usually characterized by the possession of spines in the anterior part of the dorsal and anal fins, but they are so diversified that it is almost impossible to give a clear non-technical definition.

The following key to the suborders of Acanthopteri may stand as such, for it at least gives the characters of the chief subdivisions of this great assemblage of fishes.

A. Head symmetrical with one eye on each side of head, not twisted so that both eyes are on one side.

B. Head without a large transversely laminated sucking disk.

C. Dorsal and anal fins with spines present.

D. Ventral fins abdominal, 1, 5.

E. Pectoral fins without any free flexible rays. *The Mullet-like Fishes*, 108.

EE. Pectoral fins with 7 or 8 free flexible rays, anteriorly. *The Threadfins*, 115.

DD. Ventral fins thoracic or jugular or absent.

F. Ventral fins present except as noted under **FF.**

G. Cheeks without a bony suborbital stay.

H. Ventrals not jugular, united as a ventral sucking disk or reduced to a small wisp or otherwise peculiar; (if dorsal and anal are followed by finlets sometimes absent).

I. Ventrals with more than 5 rays if body is rough or 5 or more if body is smooth and tail well forked.

J. Body deep and spiny with more than 5 rays in ventral or body not as above but with 2 long barbels on chin and 5 ventral rays. *The Berycoid Fishes*, 117.

JJ. Ventrals with from 15 to 5 rays, rarely wanting (only if finlets following dorsal and anal are present); spinous dorsal usually distinct from soft dorsal; scales not rough. *The Mackerel-like Fishes*, 120.

II. Ventrals always present.

K. Nostrils double on each side.

L. Gills 4, a slit behind the 4th.

M. Mouth small, armed with sharp teeth; body strongly compressed, deep; vertical fins densely scaled; scales rough. *The Scaly-fins*, 214.

MM. Mouth various; teeth various; body various; vertical fins not scally if body is deep and compressed; scales various. *The Perch-like Fishes*, 149.

LL. Gills 3½, no slit behind last; scales large, cycloid; teeth strong or fused into a beak. *The Labroid Fishes*, 201.

KK. Nostrils single on each side; gills 3½ or 4, with or without a slit behind. *The Demoiselles*, 198.

HH. Ventrals jugular, united as a ventral sucking disk or otherwise modified with a few exceptions.

N. Body not long and band shaped with the caudal fin turned abruptly upward.

O. Ventral fin I, 5 or united as a sucking disk.

P. No spinous dorsal, sucking disk always present, formed of folds of skin between ventrals. *The Cling Fishes*, 267.

PP. Spinous dorsal present.

Q. Sucking disk if present formed of the ventral fins themselves; body various. *The Gobies*, 252.

QQ. No sucking disk; maxillary produced into a long expanded process or dorsal preceded by an erect fleshy tab or eyes on top of head and directed upward. *The Trachinoid Fishes*, 261.

OO. Ventral rays less than I, 5, never united as a sucking disk, sometimes absent.

R. Spinous dorsal very short, its spines few; ventrals of 2 or 3 soft rays. *The Toadfishes*, 265.

RR. Spinous dorsal longer, with numerous weak rays; ventral of I spine and less than 5 soft rays; sometimes absent. *The Blennioid Fishes*, 267.

NN. Body long and band shaped with the caudal fin turned abruptly upward. *The Ribbon Fishes*, 287.

FF. Ventral fins absent. (If body is not greatly compressed, does not possess an erectile pelvic process or a spinous dorsal in which the first spine is spike-like and much larger than the rest, see under *The Mackerel-like Fishes*, *The Toadfishes* or *The Blennioid Fishes*.) Otherwise refer to. *The Trigger Fishes*, 222.

CC. Dorsal and anal without spines.

S. Ventral fins present.

T. Dorsals 2 or 3; anals I or 2. *The Jugular Fishes*, 280.

TT. Dorsal and anal single; ventrals reduced to barbels on the throat. *The Eel-pouts*, 276.

SS. Ventral fins absent.

U. Body elongate, eel-like. *The Sand Launces*, 116.

UU. Body not elongate or eel-like.

V. Body encased in an immovable triangular shell perforated only for mouth, eyes and fins; teeth small in jaws. *The Trunkfishes*, 227.

VV. Body not encased in a shell; body chunky or compressed, usually capable of being inflated; teeth fused into a parrot-like beak; body scaleless but often with spines. *The Swellfishes*, 229.

GG. Cheeks crossed by a bony sub-orbital stay.

W. Pectoral fin not split into 2 parts or with free detached rays; ventrals sometimes absent. *The Mail-cheeked Fishes*, 237.

WW. Pectoral fin split into 2 parts or with free detached rays. *The Sea Robins*, 248.

BB. Head with a large transversely laminated sucking disk above. *The Remoras*, 259.

AA. Head twisted so that both eyes are on one side. *The Flatfishes*, 288.

THE MULLET-LIKE FISHES—*Suborder Percesoces*

Primitive, rather elongate Acanthopteri with distinctly abdominal ventral fins.

A. Lateral line absent; teeth small or wanting; mouth small; gill rakers long and slender.

B. First dorsal with 3 to 9 flexible spines; anal fin with a single weak spine. *The Silversides*, 108.

BB. First dorsal with 4 stiff spines; anal fin with 3 (2 in very young). *The Mullets*, 112.

AA. Lateral line present; teeth very strong, unequal; mouth large, with jaws produced; no gill rakers. *The Barracudas*, 114.

The Silversides—*Family Atherinidæ*

Small shore fishes, with two distinct dorsal fins well separated and usually a prominent silvery lateral stripe. They are delicate fishes, living in schools of 50 or more, and nearly all of them enter fresh or at least brackish water.

A. Premaxillary narrow posteriorly, its edge nearly straight; body little compressed, the belly rounded; pectorals short; scales cycloid; vomer with teeth.

B. Scales large, 36 to 40; first dorsal with 5 or 6 spines.

C. Head very broad, about 4; the interorbital width about equal to the large eye which is about 2⅓, scales 36, anal rays I, 12 or 13. *Hardhead Silverside*, 109.

CC. Head narrow and pointed, the eye larger than interorbital width, depth, body slender and weak, depth 6; anal I, 12, scales 40. *Slender Silverside*, 109.

BB. Scales small, 45 to 52; body very slender; first dorsal long, 7 or 8 spines; anal rays I, 15; eye 2½; scales 52. *Carolina Silverside*, 110.

AA. Premaxillary broad posteriorly, its edge strongly curved; anal moderate, of 15 to 24 rays.

D. Scales laciniate; dorsal and anal scaly; anal rays I, 14 to 21; scales 43 to 50. *Rough Silverside*, 110.

DD. Scales cycloid; soft dorsal and anal mostly without scales.

E. Soft anal rays 11 to 14. *Key Silverside*, 110.

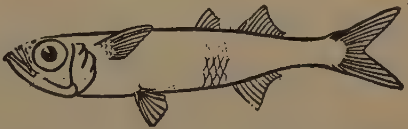
EE. Soft anal rays 15 to 24.

F. Anal rays I, 15 to 19; belly broad, not compressed; scales 38 or 39; snout larger than eye, about 2¾ in head; body about 5; soft dorsal I, 8 or 9. *Tide-water Silverside*, 110.

FF. Anal rays I, 22 to 24; head about 5 in length. *Common Silverside*, 111.

Hardhead Silverside

Hepsitia stipes (Müller & Troschel)



Known from Florida to Panama.

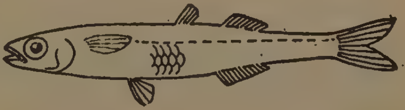
Abundant throughout the West Indies. Although common it is not favored as a bait fish by the natives.

Feeds largely on plankton.

Reaches a length of about 5 inches.

Slender Silverside

Atherina harringtonensis Goode



A species divisible into two races, only one of which occurs in our range, the other being Bermudian. They may be distinguished as follows:

A. Scales 46 to 50; dorsal rays 10 or 11; anal rays 12 or 13. *A. h. harringtonensis* Goode (The Bermuda form.)

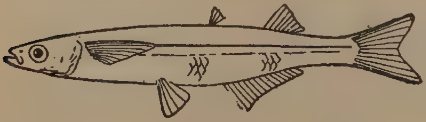
AA. Scales 42 to 43; dorsal rays 9 or 10; anal rays 11 or 12. *A. h. aræa* (Jordan & Gilbert) (The Florida and West Indian form.)

Feeds largely on plankton.

Reaches a length of about 3 inches.

Carolina Silverside *Atherina carolina* Cuvier & Valenciennes

Known only from the original description. Very likely an error. Attributed to Carolina.



Rough Silverside

Membras vagrans (Goode & Bean)

Known from New York to Mexico.
Divisible into two subspecies as follows.

A. Dorsal rays 7 to 9; anal rays 15 to 17.
M. v. vagrans (Goode & Bean).
(Gulf Coast.)

AA. Dorsal rays 7 or 9; anal rays 18 to 21.
M. v. laciniatus (Swain).

(New York to South Carolina, but not common north of Virginia.)

Various intergrades occur in Florida, and it may be that these subspecies are scarcely worthy of recognition.

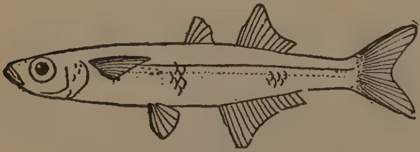
Feeds chiefly on small crustaceans and other small organisms.

In Virginia they spawn all through the warmer months.

Key Silverside *Menidia conchorum* Hildebrand & Ginsburg

Known only from Key West, Florida, where it is fairly common.

The smallest species of this genus. Not known to exceed much over 1½ inches.



Tide-water Silverside

Menidia beryllina (Cope)

North on the Atlantic coast to Massachusetts. Distribution on the Gulf coast uncertain but probably extending up the Mississippi.

Divisible into two races as below.

A. Snout shorter than eye; dorsal rays usually 10.
M. b. beryllina (Cope).

(New England to South Carolina and into the fresh waters of Florida.)

AA. Snout longer than eye; dorsal rays usually 8 or 9.
M. b. peninsulæ (Goode & Bean).

(Florida and the Gulf states, not entering fresh water.)

The food of this species consists principally of small crustaceans, mollusks and insects.

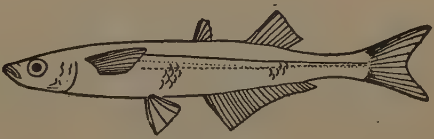
In the latitude of New York they spawn in June and July, and in Virginia from April to September. It has been suggested that the female may spawn more than once a season. The eggs are not quite spherical. Their greatest diameter averages 0.75 mm. As with other representatives of this group, there are adhesive threads on the eggs, and in this case one of them is always enlarged. They hatch in 8 to 10 days at a temperature of 78° to 82° F. The newly hatched fry average 3.5 mm. in length.

Although resembling the common silverside superficially, the present species is valued as a delicacy despite its small size, whereas the latter is not. In the fish market it is usually known as "whitebait."

Reaches a length of about 3 inches.

Common Silverside

Menidia menidia
(Linnæus)



Divisible into two races, *M. m. menidia* which reaches north on our coast to about Virginia where it intergrades with *M. m. notata* which extends to Halifax, Nova Scotia. The races may be differentiated as below.

A. Scales 39 or 40; depth about 5.
M. m. menidia (Linnæus).

AA. Scales about 46; depth about 6. *M. m. notata* (Mitchill).

The food consists largely of small worms, mollusks, etc., but also includes some vegetable matter including diatoms.

Spawns from May to July in the latitude of New York and from April to August in Virginia; and in June and July in Massachusetts. The spawning act takes place in shallow bays where great schools congregate. The eggs are spherical and average about 1.15 mm. in diameter. They are heavy and yellowish in color and mat together in lumps because of the possession of numerous adhesive threads. They hatch in 8 or 9 days at a temperature of 72° F. At a length of 15 mm. the young fish begin to resemble their parents.

This is one of our most abundant small fishes, used to a great extent for bait.

Reaches a length of 6 inches.

The Mullets—*Family Mugilidæ*

Largely tropical fishes of world wide distribution somewhat similar to the silversides but less compressed and readily differentiated from them by the less numerous dorsal spines which are 4 in number and the different form of the mouth.

A. Soft dorsal and anal scaleless; anal III, 8; sides with dark longitudinal stripes along scale rows; caudal deeply forked.

B. Scales about 31 to 36; depth about 4.5; cleft of mouth much wider than deep. *Brazilian Mullet*, 112.

BB. Scales about 37 to 41; depth about 4.0; cleft of mouth only slightly wider than deep. *Striped Mullet*, 113.

AA. Soft dorsal and anal closely scaled; sides without dark stripes along scale rows; caudal not deeply forked.

C. Anal III, 9; scales 35 to 41; cleft of mouth not nearly twice as wide as deep. *White Mullet*, 113.

CC. Anal III, 8; scales 29 to 31; cleft of mouth nearly twice as wide as deep. *Fan-tail Mullet*, 113.

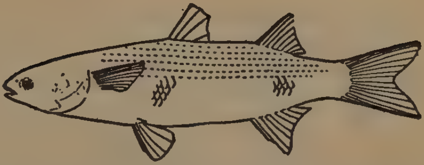
Brazilian Mullet *Mugil brasiliensis* Agassiz

Known from Cuba to Patagonia but probably straying to Florida.

An important food fish in its range, as are most of the mullets when reaching sufficient size.

Reaches a length of 18 inches.

Striped Mullet
Mugil cephalus
Linnæus
LaMonte, Pl. 6



Cosmopolitan in warm and temperate seas, extending northward on our coast to Maine but rare north of New York.

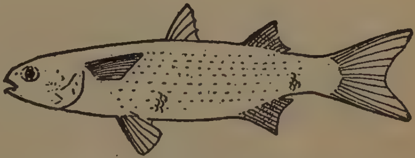
All the mullets are of importance where they occur in sufficient quantities to be commercially valuable.

With growth the intestine progressively lengthens and becomes more and more convoluted. This is probably related to a change in feeding habits. The very young feed on readily assimilated plankton and the adults, to a large extent, on more resistant marine vegetation.

In the latitude of New York this species is supposed to hibernate in winter.

In the southern part of their range striped mullet may reach as much as 2 feet in length but in the northern part seldom over a foot.

White Mullet
Mugil curema
Cuvier &
Valenciennes



Cosmopolitan in warm and temperate seas, reaching north to Cape Cod on our coast, although an essentially southern species.

The habits of this species are very similar to those of the striped mullet. It is not known how far north the breeding range extends but it appears to be at its height in May and June.

In the tropical part of its range the white mullet may reach as much as 3 feet.

Fan-tail Mullet *Mugil trichodon* Poey

South Atlantic states to Brazil. Common about the Florida Keys.

The young of this and other mullets show but 2 anal spines up to about 2 inches in length.

Reaches a length of about a foot.

The Barracudas—*Family Sphyrænidæ*

Large voracious fishes of the tropics readily recognized by their powerful dentition, pike-like build, and their lack of gill-rakers. These fishes when sufficiently large are a real danger to bathers and are responsible for most of the attacks commonly attributed to sharks. The author has personally seen the truly terrible results that may follow ignoring the presence of these fishes when bathing in the tropics. Although only too many sea dangers are grossly exaggerated, that this is one not to be trifled with, he can attest.

A. Scales large, 75 to 85; origin of first dorsal behind root of ventrals, body compressed, lower jaw with a fleshy tip. *Great Barracuda*, 114.

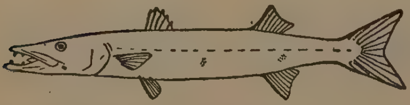
AA. Scales smaller, 110 to 150, body not especially compressed.

B. Scales 110 to 135; lower jaw without a fleshy tip.

C. Pectorals reaching front of first dorsal and past base of ventrals; maxillary reaching front of orbit; origin of first dorsal after ventral insertion; scales about 120. *Guaguanche*, 115.

CC. Pectorals not reaching front of first dorsal or base of ventrals; maxillary not reaching orbit; first dorsal over ventral insertion; scales about 135. *Northern Barracuda*, 115.

BB. Scales 150, origin of first dorsal well behind tip of pectorals, before ventrals; lower jaw with a fleshy tip. *European Barracuda*, 115.



Great Barracuda

Sphyræna barracuda (Shaw)

LaMonte, pl. 6

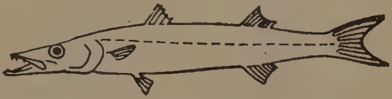
A typical West Indian species regularly reaching South Carolina and straggling rarely to Massachusetts.

This is the species thoroughly established as being dangerous to bathers. This is fact and not open to question in the sense that some shark records are. Indeed, many of the stories relative to accidents with sharks are referable to the barracuda, which with its knife-like edged teeth is able to inflict a deep and often serious cut which is always quite different from the jagged tear that any shark is forced to make in feeding on flesh, by the nature of its semi-circular saw-like dentition.

Reaches a length of 10 feet, but rare over 5.

Guaguanche

Sphyræna guachancho Cuvier & Valenciennes



West Indies, north to Pensacola and occasionally to Massachusetts. Common in the tropics.

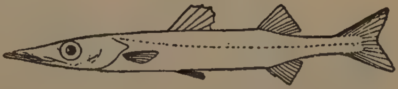
A rather slender species, too small to be dangerous.

Feeds on smaller fishes.

Reaches a length of 2 feet.

Northern Barracuda

Sphyræna borealis De Kay



Known from Panama to Cape Cod, becoming more common in the southern part of its range.

This smaller relative of the great barracuda resembles the latter to a considerable extent, as far as its small size will permit. Its habits are generally similar so far as size allows, being predacious and feeding chiefly on fishes.

Reaches a length of rarely more than 12 inches.

European Barracuda *Sphyræna sphyræna* (Linnæus)

A straggler from the east which may reach our shores at times. It should be looked for on the north Atlantic coast.

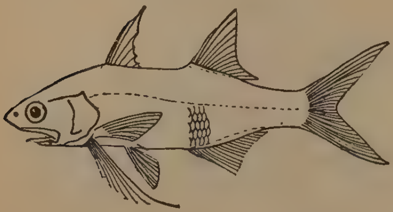
THE THREADFINS—*Suborder Rhegnopteri*

A single family of rather uncertain relationships.

The Threadfins—*Family Polynemidæ*

A family of uncertain position easily recognized by the long produced lower pectoral rays with the combination of its other characters.

A. Pectoral filaments 7. *Barbu*, 116.
AA. Pectoral filaments 8. *Eight-fingered Threadfin*, 116.



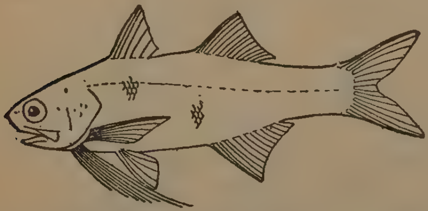
Barbu

Polynemus virginicus Linnæus

West Indies north to the Florida Keys.

A food fish of some importance at and about Key West.

Reaches a little over a foot in length.



Eight-fingered Threadfin

Polynemus octonemus Girard

A fish of South Atlantic and Gulf Coasts rarely straggling north to Massachusetts.

A species of sandy shores.

Reaches a length of nearly a foot.

THE SAND LAUNCES—*Suborder Ammodytoidei*

A single family of unknown relationships.

The Sand Launces—*Family Ammodytidæ*

Long slim fishes of uncertain position. They are typically fishes of northern seas.

A. Dorsal 64 to 67, anal 33 to 36, lateral folds 150; head 6½. *Northern Sand Launce*, 117.
AA. Dorsal 60, anal 28, lateral folds 125 to 130, head 4¾. *Sand Launce*, 117.

Northern Sand Launce *Ammodytes dubuis* Reinhardt

An inhabitant of Greenland waters, recorded as far south as Cape Cod. Possibly not distinct from the following species.

Sand Launce

Ammodytes americanus De Kay

Known from Labrador and Newfoundland to Cape Hatteras, more common to the north of its range.

The sand launce lives to a great extent in the surf of sandy shores, diving in and out of the loose sand with remarkable alacrity. They are frequently cast up on the beach and then form an item of importance in the diet of gulls and other shore forms.

Sometimes they swim at the surface near shore in numbers and then again fall prey to hovering gulls.

They in turn feed chiefly on small crustaceans.

They average about 4 inches in length, but may reach as much as 7.

The Berycoid Fishes—*Suborder Berycoidei*

A rather varied group which retain many primative characters.

A. Chin without barbels; ventral fins I, 6 to I, 10; dorsal fin single with strong spines; scales rough; anal spines 4. *The Squirrel Fishes*, 117.

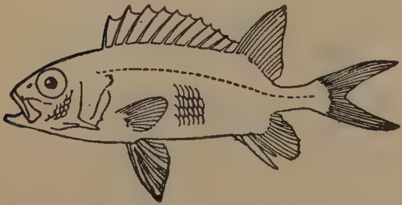
AA. Chin with 2 long barbels; ventral fins I, 5; dorsal fins separate; scales nearly smooth; anal spines 1 or 2. *The Goat Fishes*, 118.

The Squirrel Fishes—*Family Holocentridæ*

Tropical fishes usually inhabiting coral reefs. Their colors usually tend towards the brighter reds. Although only two species are recorded in our region, numerous others occur just south of it, and may be expected to intrude themselves.

A. Caudal lobes notably produced, the upper one much longer than lower; scales 47 to 51; color chiefly plain red. *Common Squirrel Fish*, 118.

AA. Caudal lobes not notably produced, equal in length; scales 42, dorsal with a prominent black blotch anteriorly; body reddish with prominent longitudinal streaks. *Tortuga Squirrel Fish*, 118.



Squirrel Fish

Holocentrus ascensionis (Osbeck)

Known from Florida to Brazil.

A common and showy reef fish, much given to hiding in the shelter of holes and overhanging pieces of coral.

Somewhat used for food.

Reaches a length of 2 feet but specimens over a foot in our range are uncommon.

Tortuga Squirrel Fish *Holocentrus tortugæ* Jordan & Thompson

A rare species known chiefly from the vicinity of the Tortugas Islands.

Probably does not reach over a foot in length.

The Goatfishes—*Family Mullidæ*

Tropical fishes easily recognized by the combination of a long double barbel on the chin, two dorsal fins, a forked tail and with rather brilliant colors on the sides.

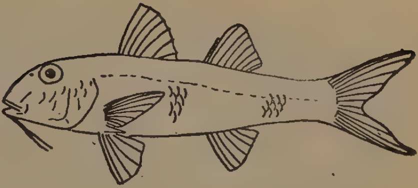
A. Teeth on lower jaw, vomer and palatines, upper jaw toothless; opercle without a spine. *Northern Goatfish*, 119.

AA. Teeth in both jaws; vomer and palatines toothless; opercle with one spine.

B. Teeth in both jaws uniserial (or irregularly biserial above); eye 4, scales 31; sides with 3 black blotches. *Spotted Goatfish*, 119.

BB. Teeth in both jaws biserial in front; scales 37 to 39; eye 3¼; red with a yellow lateral streak. *Yellow Goatfish*, 119.

Northern Goatfish
Mullus auratus
Jordan & Gilbert

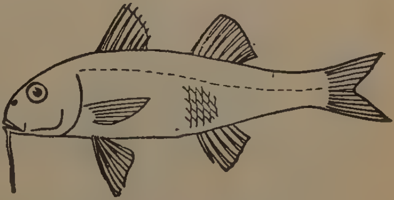


A West Indian species, known from Florida and to Cape Cod as a straggler.

A typical sandy bottom fish, provided with sensory barbels on the chin.

Reaches a length of about 8 inches.

Spotted Goatfish
Upeneus maculatus
(Bloch)



A West Indian species reaching north to Florida.

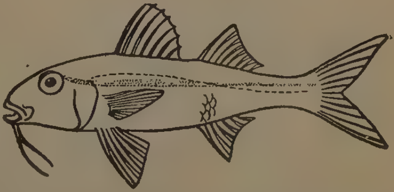
Color chiefly red in life.

A food fish of some value.

Feeds on general débris.

Reaches nearly a foot in length.

Yellow Goatfish
Upeneus martinicus
Cuvier & Valenciennes



A West Indian species reaching north to the Florida Keys.

One of the most handsome goatfishes, largely yellow in color.

Reaches a length of 1 foot.

THE MACKEREL-LIKE FISHES—*Suborder Scombroidei*

A large group of mostly oceanic fishes of variable characteristics.

A. Ventral fins each composed of about 15 soft rays; body deep, compressed, unarmed and covered with minute scales; fins red, body silvery. *The Opahs*, 145.

AA. Ventral fins with less than 8 soft rays, usually I, 5, sometimes wanting.

B. Bones of snout and upper jaw united and prolonged into a distinct sword; scales minute or obsolete.

C. Ventrals of 1 to 3 rays each; teeth present; scales present. *The Sailfishes*, 129.

CC. Ventrals absent; teeth absent; scales obsolete. *The Swordfishes*, 130.

BB Bones of snout not produced as a sword.

D. Body fusiform or band-shaped; scales minute; caudal fin well forked and on a slender peduncle (the fin sometimes absent); lower jaw well developed, usually with a slit in the flesh to permit its motion; dorsal and anal long, the spinous portion well developed; the fin usually followed by a number of finlets.

E. Caudal fin present.

F. Body moderately elongate, fusiform; caudal peduncle with a distinct keel; finlets always present; ventrals I, 5. *The Mackerels*, 121.

FF. Body decidedly elongate; caudal peduncle without a keel; finlets present or absent; ventrals I, 5 or variously reduced. *The Escolars*, 128.

EE. Caudal absent; the body tapering to a point; ventrals rudimentary or wanting; dorsal and anal very long and low, continuous. *The Cutlass Fishes*, 128.

DD. Body and fins various but not showing the combination of characters mentioned under D.

G. Scales if present, cycloid or ctenoid but not hard and bony, sometimes, especially in the young with a median ridge on each; caudal fin lunate or forked (or if rounded, the dorsal with very weak spines); anal fin not longer than dorsal; spinous dorsal well developed; ventrals smaller than pectorals.

H. First dorsal with its rays connected by a membrane (the membrane rarely obsolete with age); head compressed.

I. Anal preceded by 2 free spines (these sometimes obsolete with age or connected by a membrane in the very young).

J. Scales minute or obsolete, cycloid; those along lateral line often developed into hard bony plates; tail deeply forked. *The Jacks*, 131.

JJ. Scales moderate; lateral line unarmed; tail not deeply forked. *The Bluefishes*, 142.

II. Anal without free spines; scales moderate; dorsal fin very long; caudal little forked. *The Rudder-fishes*, 146.

HH. Spinous dorsal represented by several free spines; body elongate; the head depressed; caudal little forked. *The Cobias*, 143.

GG. Scales various; spinous dorsal not developed or if developed the ventrals larger than the pectorals or the body with bony scales.

K. Throat with tooth-like processes; spinous dorsal undeveloped; ventrals absent; body deep, compressed, silvery; caudal well forked. *The Harvest Fishes*, 147.

KK. Throat without tooth-like processes; spinous dorsal present or absent; the body deep if spinous dorsal is present.

L. Ventral fins larger than pectorals; body mottled with a strong pattern. *The Man-of-war Fishes*, 143.

LL. Ventral fins not as large as the pectorals.

M. Dorsal fin not beginning on head or scales not hard and bony.

N. Spinous dorsal with 3 or 4 weak spines; no ridge on each scale. *The Pomfrets*, 145.

NN. Spinous dorsal with 10 to 12 spines; each scale with a median ridge. *The Deep-water Pomfrets*, 146.

MM. Dorsal beginning on head or scales hard and bony.

O. Dorsal beginning on head; scales very small, not hard and bony. *The Dolphins*, 144.

OO. Dorsal beginning further back; scales hard and bony, not very small. *The Square-tails*, 148.

The Mackerels—*Family Scombridæ*

Oceanic fishes, frequently of large size. They are all fast swimmers and may be recognized by a series of small finlets following both dorsal and anal and 1 to 3 distinct keels on the peduncle. There are no bony scutes on the posterior part of the lateral line.

A. Caudal peduncle without a median lateral keel on each side; dorsal fins well separated; spinous dorsal short, of 9 to 12 spines; body scaly; slender teeth on vomer and palatines; maxillary entirely covered by preorbital; pectoral inserted on level of eye.

B. Dorsal spines 11 or 12; sides of body below median line silvery; no air bladder. *Common Mackerel*, 123.

BB. Dorsal spines 9 or 10; sides of body below median line mottled; air bladder present. *Chub Mackerel*, 124.

AA. Caudal peduncle with a median keel; a smaller keel above and below it; pectorals usually inserted below eye.

C. Dorsal spines 10 to 16; teeth entire.

D. Body scaleless, excepting about lateral line and an anterior corselet.

E. Dorsals well separated, by more than ½ head; corselet well developed; teeth small, some present on vomer, none on palatines; gill rakers long, slender and numerous. *Frigate Mackerel*, 124.

EE. Dorsals contiguous, the interspace more than 5 in head, palatine teeth villiform; vomer toothless, dorsal spines 15 or 16.

F. Lateral line with a decided curve below second dorsal; 4 lengthwise stripes on sides of body below lateral line. *Ocean Bonito*, 124.

FF. Lateral line without a distinct curve, no stripes below lateral line. *False Albacore*, 125.

DD. Body wholly covered with small scales, those in the corselet and lateral line sometimes larger; dorsal spines 14 to 26.

G. Teeth of jaws slender; little, if at all, compressed; gill rakers numerous; corselet distinct; pectorals inserted low.

H. Vomer and palatines with villiform or granular teeth; body robust.

I. Pectoral short; not reaching much beyond the tips of the moderate ventrals.

J. Soft dorsal and anal not excessively elongate, not nearly reaching peduncle; depth about 4. *Tunny*, 125.

JJ. Soft dorsal and anal excessively elongate, nearly reaching or exceeding peduncle; depth about 3½.

K. Pectoral 1½ in head. *Autumn Albacore*, 125.

KK. Pectoral over 2 in head. *Allison's Tunny*, 125.

II. Pectorals very long, reaching much beyond front of anal. *Long-finned Albacore*, 126.

HH. Vomer toothless; palatines with a single row of rather strong conical teeth; body elongate, slightly compressed; dorsal spines 21; maxillary not reaching beyond orbit.

L. Conspicuous horizontal black stripes on back; mouth very large; first dorsal short. *Striped Bonito*, 126.

LL. Inconspicuous dark stripes on back running upward and back; mouth not unusually large; first dorsal rather long. *Common Bonito*, 126.

GG. Teeth of jaws strong, sub-triangular or knife-like, more or less compressed, villiform teeth on vomer and palatines; dorsal spines 14 to 18.

M. Soft dorsal inserted in advance of anal; fins not closely scaled; lateral line not abruptly decurved. *Spanish Mackerel*, 127.

MM. Soft dorsal inserted over anal.

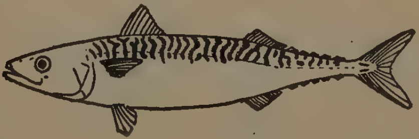
N. Body deep, less than 5; about 40 teeth in each jaw; fins closely scaled; lateral line not abruptly decurved. *Painted Mackerel*, 127.

NN. Body slender, about 6; about 30 teeth in each jaw; lateral line abruptly decurved. *King Mackerel*, 127.

CC. Dorsal spines 24 to 26, teeth serrated, large and compressed; snout fused into a short beak. *Wahoo*, 127.

Common Mackerel

Scomber scombrus Linnæus



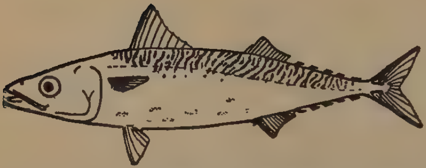
LaMonte, pl. 7

Occurs in the North Atlantic north to Norway and Labrador and south to Spain and Cape Hatteras.

Grown mackerel approach the coast in spring and move offshore and into deeper water in fall.

Mackerel spawn from May to July. The eggs average 1.25 mm. in diameter, are buoyant and non-adhesive. An average female may produce about 41,000. A fish weighing 1⅛ pounds is recorded as producing 546,000 eggs. The eggs hatch in five days at a temperature of about 56° F.

Adult mackerel average about a foot in length and a pound in weight, but records go as high as 20 inches and 3½ pounds.

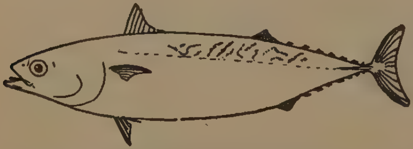


Chub Mackerel
Pneumataphorus colias Gmelin

Occurs in warm and temperate parts of the Atlantic north to the Gulf of St. Lawrence, rarely south to Virginia.

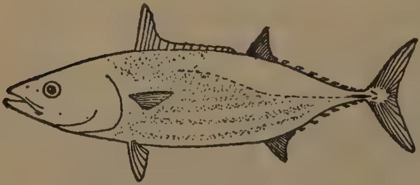
The chub mackerel greatly resembles the common mackerel in both appearance and habits and not infrequently the great schools of each merge. However, when viewed from above as from a wharf or deck the two may be easily distinguished for the pattern of reticulations on the back of the chub mackerel is about twice as fine as on the common mackerel, and the present species has a much more conspicuous translucent area on the snout.

Reaches a length of about 14 inches although usually smaller.



Frigate Mackerel
Auxis thazard (Lacépède)

Occurs in warm seas, casually northward to Cape Cod. Said to move in large schools but very erratic in appearance. Reaches a length of a foot or more.



Ocean Bonito
Gymnosarda pelamis (Linnæus)
LaMonte, Pl. 8

An offshore species occurring north to Cape Cod.

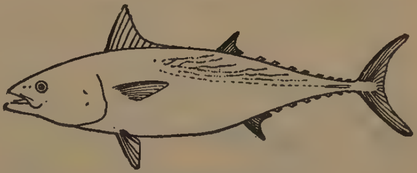
The ocean bonito is most common in the trade wind belts and small schools travel about preying to a considerable extent on flying fish.

Reaches a length of about 2 feet and a weight of about 20 pounds.

False Albacore

Gymnosarda alleterata (Rafinesque)

LaMonte, PL. 10



Cosmopolitan in warm seas occasionally north to Cape Cod on our coast.

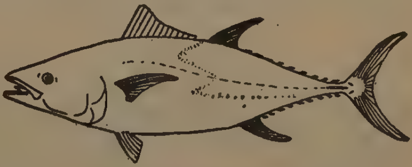
Feeds largely on squid and fish.

Reaches a length of about 3 feet and a weight of 20 pounds.

Tunny

Thunnus secundodorsalis (Storer)

LaMonte, PL. 9



North to Nova Scotia. Questionably distinguished from the European tunny. (T. thynnus)

Feeds largely on fish (particularly on mackerel and menhaden) and squid.

The coloring of the live fish is remarkably beautiful, being a dark steel blue above and silvery below with some of the fins various shades of yellow. The sides are shot with tints of green, pink, and other iridescent hues.

Reaches as high as 10 feet 4 inches in length and a weight of 710 pounds. Reports have it reaching a weight of 1500 pounds.

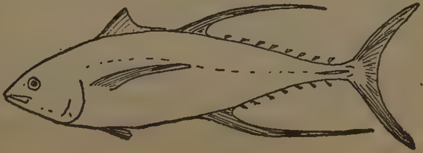
Autumn Albacore *Neothunnus albacores* (Bonnaterre)

A little known form supposed to reach north to Florida. Possibly not distinct from the following.

Allison's Tunny

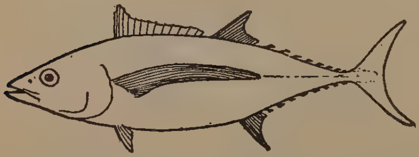
Neothunnus allisoni (Mowbray)

LaMonte, PL. 9



A handsome species recently described from Florida and since recorded from the Pacific.

Known to reach nearly 6 feet in length.



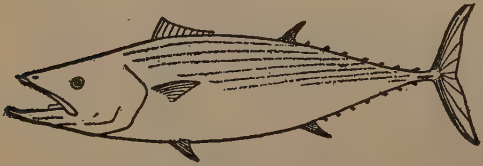
Long-finned Albacore

Germo alalunga (Gmelin)

LaMonte, Pl. 7

Cosmopolitan in warm seas. Rare on our coast north of Florida, but straggles as far as Massachusetts.

Reaches a weight of 66¼ pounds.



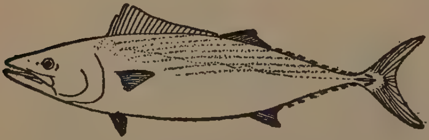
Striped Bonito

Sarda velox Meek & Hildebrand

Cf. LaMonte, p.2

A recently described but well marked species (1923) known from Block Island on our coast and Panama City. Probably cosmopolitan.

Block Island specimens 23½ and 24 inches, the largest weighing 7 pounds.



Common Bonito

Sarda sarda (Bloch)

LaMonte, Pl. 8

Occurs on both Atlantic coasts north to Maine and abundant to Cape Cod.

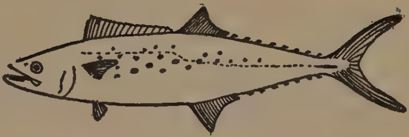
Spawns in June.

Feeds chiefly on fishes and squid. Usually taken at the surface but occasionally from near the bottom.

Reaches a length of somewhat over 3 feet and 10 or 12 pounds in weight.

Spanish Mackerel

Scomberomorus maculatus
(Mitchill)
LaMonte, PL. 11



Occurs from Brazil to Cape Ann and accidentally to Maine. Very abundant in the Gulf of Mexico and north to North Carolina.

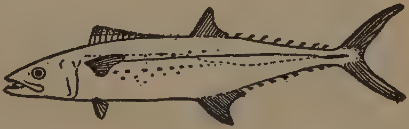
Spawns offshore in spring and summer apparently at night. The eggs are non-adhesive, buoyant, and highly transparent, and hatch in 21 hours at a temperature of 81° F. An average female may produce about 20,000. In the latitude of New York they spawn as late as September.

Feeds chiefly on fishes.

Reaches a weight of about 10 pounds.

Painted Mackerel

Scomberomorus regalis
(Bloch)



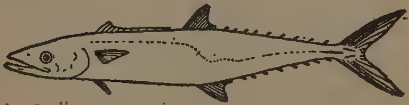
Occurs from Brazil to Cape Cod, generally scarce but common about the Florida Keys.

The food consists mostly of small fish.

Reaches a length of 6 feet and a weight of 20 pounds.

King Mackerel

Scomberomorus cavalla
(Cuvier & Valenciennes) LaMonte, PL. 11



Occurs in the warm parts of the North Atlantic, south to Brazil. Formerly, at least, abundant along the Florida Keys.

Their food consists chiefly of fish and squid.

Reaches a length of about 5 feet and a weight of 100 pounds.

Wahoo *Acanthocybium solandri* (Cuvier & Valenciennes) LaMon
PL. 10.

Tropical Atlantic, north to southern Florida where it is not uncommon.

Known to spawn about Cuba. A large species valued as food.

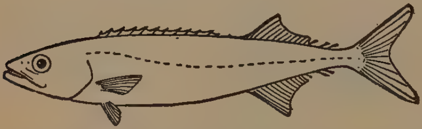
Reaches a length of over 6 feet and a weight of up to 100 pounds.

The Escolars—*Family Gemphlidæ*

Essentially deep water, mackerel-like fishes occurring in our region only as strays.

A. Body fusiform; only a few finlets; dorsal spines 15. *Escolar*, 128.

AA. Body greatly elongated; dorsal and anal finlets 6; dorsal spines 30. *Snake mackerel*, 128.



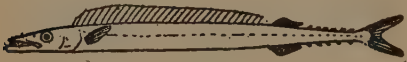
Escolar

Ruvettus pretiosus Cocco

Cosmopolitan in rather deep water, sometimes coming close to the surface. Usually tropical, but straying into the North Atlantic to the Grand Banks of Newfoundland. Very rare in our territory.

The flesh is rich and oily and is reputed to have a purgative effect.

Reaches a weight of at least 100 pounds.



Snake Mackerel

Gempylus serpens Cuvier & Valenciennes

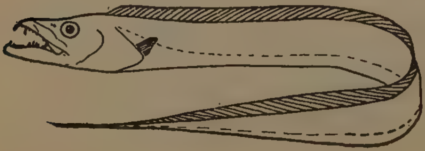
Cosmopolitan in warm seas.

A deep water form known on our coast as far north as New York mostly from dead specimens washed ashore.

Reaches a length of 44 inches.

The Cutlass Fishes—*Family Trichiuridæ*

A family represented by a single species on our coast.



Cutlass Fish

Trichiurus lepturus Linnæus

Occurs in warm Atlantic north to Virginia and straggles north to Massachusetts.

Spawns during the summer.

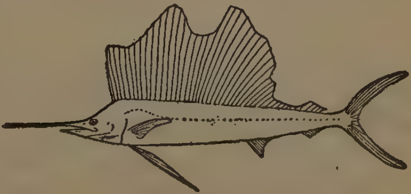
Feeds largely on fishes.

Reaches a length of about 5 feet but generally much smaller.

The Sailfishes—*Family Istiophoridæ*

A family of long snouted mackerel-like fishes of the open seas. They are widely distributed in all oceans. As a sport fish for sea anglers they appear to be constantly becoming of more interest.

A. Dorsal fin greatly elevated; ventral fins very long.
B. Dorsal spines 48; the last 6 or 12 spines short stubs. *Atlantic Sailfish*, 129.
BB. Dorsal spines 40 or less; no stub-like spines between dorsals.
C. Dorsal spines 32; interspace between dorsals little longer than eye. *Wright's Sailfish*, 130.
CC. Interspace between dorsals greater, almost equal to height of lobe, no stub-like spines between fins.
D. Dorsal spines 40; dorsal profusely spotted with black. *McGuire's Sailfish*, 130.
DD. Dorsal spines 33; dorsal sparsely spotted. *Florida Sailfish*, 130.
AA. Dorsal fin not greatly elevated, its anterior rays thickened; ventral fins very slender. *Spearfish*, 130.



Atlantic Sailfish
Istiophorus nigricans
(Lacépède)
LaMonte, Pl. 12

Occurs in the warmer parts of the Atlantic north to Florida, where it is common, and straggles north to Massachusetts.

Reaches a length of about 6 feet. The record is 8 feet 4 inches and a weight of 95 pounds.

Wright's Sailfish *Istiophorus wrighti* Jordan & Evermann

Known only from the coast of Florida.

Described from small specimens of 5½ pounds and under. Possibly the young of some other species.

McGuire's Sailfish *Istiophorus mcguirei* Jordan & Evermann

Known only from the Florida Keys.

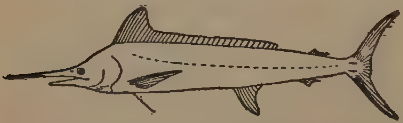
The status of all the species of *Istiophorus* is uncertain because of the difficulty encountered by ichthyologists in obtaining adequate material in the proper condition for study.

Reaches a length of 7 feet 2 inches.

Florida Sailfish *Istiophorus volador* Jordan & Evermann

Known only from the Florida Keys.

This appears to be the common sailfish of Florida waters; the form usually represented on advertising posters, et cetera.



Spearfish

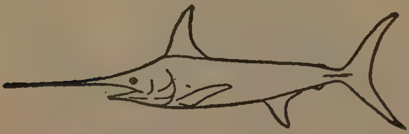
Tetrapterus imperator (Bloch & Schneider)

Occurs in the warmer parts of the Atlantic, northward to Cape Cod and casually to Maine.

Reaches a length of 7 feet and is reported to reach 26 feet!

The Swordfishes—*Family Xiphiidæ*

A family of a single species easily identified by the combination of a long pointed rostrum and a short height "shark-like" dorsal fin.



Swordfish

Xiphias gladius Linnæus

LaMonte, Pl. 12.

Cosmopolitan in warm seas reaching north to Massachusetts on our coast.

Swordfish spend considerable time in deep water, sometimes being taken on trawl lines at a depth of 80 fathoms. However, they are not infrequently found at the surface.

In specimens of less than half a pound the skin is beset with spinules and the dorsal and anal are larger and higher.

A scarce but highly valued food fish.

They reach a length of 16 feet and a weight of 800 pounds, although they are usually less than half that.

The Jacks—*Family Carangidæ*

For most part widely distributed and often largely oceanic fishes, many of which are valued as food. Although highly diversified most of our species have a prominent hard keel on the posterior part of the lateral line which serves to strengthen the rather narrow peduncle.

A. Lateral line wholly or in part armed with bony scutes (weak and sometimes absent in the bumper).

B. Dorsal and anal each with a single detached finlet.

C. Scutes of lateral line 40 to 50; depth about 5; teeth on jaws, vomer and palatines. *Round Scad*, 134.

CC. Scutes of lateral line 20 to 30; depth about 5.75; teeth obsolete. *Mackerel Scad*, 134.

BB. Dorsal and anal without finlets.

D. Shoulder girdle with a deep furrow near its juncture with the isthmus and a fleshy projection above it; eye 2.75 to 3.17. *Goggle-eyed Scad*, 134.

DD. Shoulder girdle not as above; eye smaller.

E. Lateral line armed with bony scutes for its entire length; last ray of dorsal and anal enlarged but not separate from rest of fin. *Rough Scad*, 134.

EE. Lateral line with bony scutes on its straight (posterior) portion only, last ray of dorsal and anal not notably enlarged.

F. Maxillary very narrow; head 4.0 to 4.4; teeth in a single close set series in jaws, few or none on vomer, palatines and tongue; dorsal and anal low, never with salient lobes, each with a conspicuous sheath of scales at base. *Blunt-nosed Jack*, 135.

FF. Maxillary broad, head longer; teeth in one or more series, or in bands on jaws, never in a single close set series.

G. Teeth uneven, in one or a few series on jaws, persistent; villiform teeth usually present on vomer, palatines and tongue, these deciduous or wanting in some species.

H. Gill-rakers 13 to 18 exclusive of rudiments on the lower limb of the first arch.

I. Breast naked, with only a small triangular patch of scales in front of ventrals; a large opercular spot present. *Common Jack*, 135.

II. Breast covered with small scales.

J. Dorsal and anal completely covered with small scales; gill-rakers 17 or 18; dorsal VIII–I, 26 to 28; anal II–I, 22 to 24; no opercular spot. *Yellow Jack*, 135.

JJ. Dorsal and anal with scales only on the elevated portions; gill-rakers 13 or 14; dorsal VIII–I, 20 to 22; anal II–I, 17 or 18; a small opercular spot. *Horse-eye Jack*, 136.

HH. Gill-rakers 24 to 32, exclusive of rudiments on the lower limb of first arch.

K. Dorsal with 27 or 28 soft rays; anal with 23 or 24; lateral scutes 30 to 35; gill-rakers 30 to 32. *Skip-jack*, 136.

KK. Dorsal with 23 to 25 soft rays; anal with 19 or 20; lateral scutes 40 to 50; gill-rakers 24 to 25. *Hard-tailed Jack*, 136.

GG. Teeth minute but even, in a single series or in villiform bands on jaws, also present on vomer, tongue and usually palatines at all ages.

L. Back much elevated; the dorsal outline more strongly curved than the ventral.

M. Snout well in advance of the forehead; anterior profile convex; anterior rays of second dorsal and anal filamentous.

N. Soft dorsal and anal lobe greatly produced as long thread-like streamers; depth 1.25 to 2.0. *Thread-fish*, 137.

NN. Soft dorsal and anal lobes produced but not excessively so or thread-like; depth 2.25. *Cuban Jack*, 137.

MM. Snout scarcely in advance of forehead; anterior profile nearly vertical; soft dorsal and anal low; never falcate, the anterior rays not produced or filamentous. *Moonfish*, 137.

LL. Back little elevated; the ventral outline much more strongly curved than the dorsal; lateral line with a few very weak scutes or none. *Bumper*, 138.

AA. Lateral line entirely unarmed.

O. Second dorsal and anal about equal in length, both longer than the abdomen.

P. Body deep, ovate; premaxillaries protractile; second dorsal and anal fins anteriorly elevated, falcate.

Q. Body very greatly compressed, the outlines everywhere trenchant; preorbital extremely deep; maxillary broad, with a well developed supplemental bone. *Look-down*, 138.

QQ. Body less greatly compressed, the abdomen never trenchant, preorbital very narrow; maxillary narrow, without a distinct supplemental bone.

R. Dorsal with 19 or 20 soft rays; anal with 17 to 19.

S. Sides with narrow black cross bars, lobes of dorsal and anal reaching past middle of caudal fin in adult. *Palometo*, 138.

SS. Sides without black cross bars, lobes of dorsal and anal rarely reaching to base of caudal fin in adult.

T. Body depth about 1.7; profile strongly arched; dorsal lobe longer than head. *Round Pompano*, 139.

TT. Body depth about 2.6; profile not strongly arched; dorsal lobe not longer than head. *Great Pompano*, 139.

RR. Dorsal with 25 soft rays; anal with 22.

U. Depth about 2.0. *Silvery Pompano*, 139.

UU. Depth about 2.5. *Common Pompano*, 140

PP. Body oblong; premaxillaries not protractile, except in very young; maxillary narrow without supplemental bone; second dorsal and anal fins low, not falcate. *Leather-jacket*, 140.

OO. Anal fin much shorter than second dorsal, its base shorter than abdomen.

V. Dorsal and anal each with a single detached finlet composed of 2 rays. *Runner*, 140.

VV. Dorsal and anal without finlets.

W. First dorsal with 6 to 8 slender spines connected by a membrane at all ages; lateral line with a long low arch, forming a slight soft keel on the peduncle in the adult.

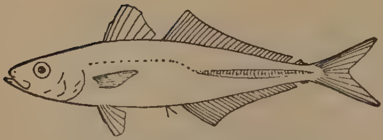
X. Head deeper than long, the anterior profile steep; dorsal rays 27 to 30; gill-rakers about 22. *European Amber-jack*, 141.

XX. Head longer than deep, the anterior profile not very steep; dorsal rays 30 to 38; gill-rakers 17 or 18.

Y. Dorsal rays 30 to 34; maxillary reaching to or past middle of eye. *Great Amber-jack*, 141.

YY. Dorsal 36 to 38; maxillary reaching middle of eye. *Banded Rudderfish*, 141.

WW. First dorsal with 3 or 4 low stiff spines separated in adult or connected by a membrane in very young; lateral line scarcely arched, forming a prominent dermal keel on peduncle. *Pilotfish*, 142.



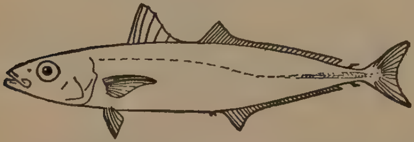
Round Scad

Decapterus punctatus Agassiz

Occurs from Cape Cod to Brazil.

The young, at least, feed on copepods and worms to a large extent.

Reaches a length of about a foot.

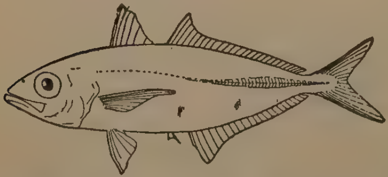


Mackerel Scad

Decapterus macarellus (Cuvier & Valenciennes)

Warm Atlantic waters straying north to Nova Scotia. Sometimes abundant in fall as far north as Massachusetts.

Reaches a length of about a foot.



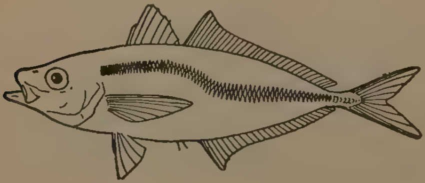
Goggle-eyed Scad

Selar crumenopthalmus (Bloch)

Cosmopolitan in warm seas north to Cape Cod.

Feeds largely on small fish, worms, et cetera.

Reaches a length of about 10 inches.



Rough Scad

Trachurus lathami Nichols

Occurs on our Atlantic coast as far north as Massachusetts. Sometimes common off the Florida Keys.

Reaches a length of about 9 inches.

Blunt-nosed Jack *Hemicaranx amblyrhynchus* (Cuvier & Valenciennes)

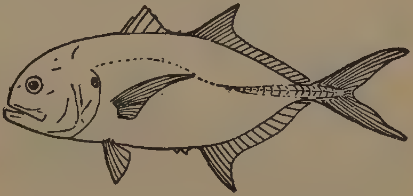
Known from Cape Hatteras to Brazil.

Common in parts of the West Indies but only occasional in our range. Sometimes taken in fair numbers under jellyfish in the lower Mississippi. These are usually small examples.

Does not reach a large size.

Common Jack
Caranx hippos
(Linnæus)

LaMonte, Pl. 13

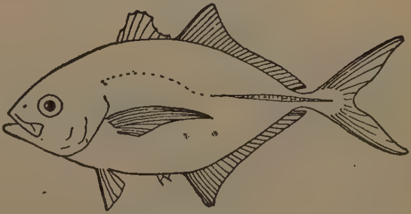


Occurs on the warm coasts of the Atlantic and as far north as Massachusetts. Also known from the eastern Pacific.

Feeds largely on fishes.

Reaches a length of about 2½ feet and a weight of about 20 pounds.

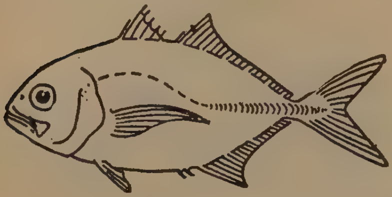
Yellow Jack
Caranx bartholomæi
(Cuvier &
Valenciennes)



Occurs in the West Indies, the young north to North Carolina and rarely to Massachusetts.

As is common with most species of this genus the young are considerably deeper of body than the adults. At small sizes they drift about in ocean currents usually under clumps of gulf-weed or floating wreckage.

Reaches a length of about 15 inches.



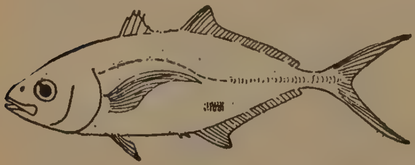
Horse-eye Jack

Caranx latus
Agassiz

West Indian, reaching northward to Virginia. More southerly in distribution than the common jack.

Feeds mostly on small fishes.

Reaches nearly 2 feet in length.

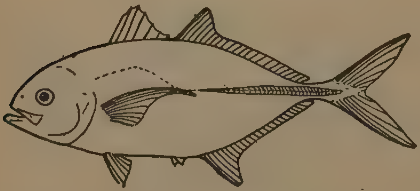


Skip-jack

Caranx ruber
(Bloch)

West Indies, sometimes north to Florida and recorded as far north as North Carolina.

Reaches a length of about a foot.



Hard-tailed Jack

Caranx crysos
(Mitchill)

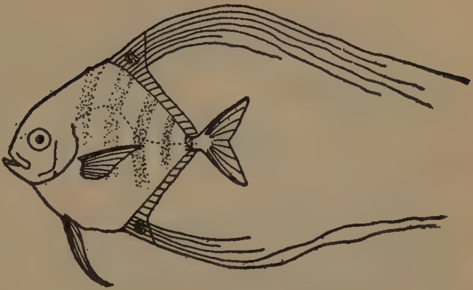
LaMonte, Pl. 13

Occurs from Brazil to Cape Cod and casually to Nova Scotia. Also known from the eastern Pacific.

Feeds largely on small fishes and shrimps.

Reaches a length of about 20 inches and a weight of about 4 pounds.

Threadfish
Alectis ciliaris
(Bloch)



Cosmopolitan in tropical seas, the young reaching as far north as Massachusetts on our coast.

Formerly thought to be an independent species but now believed to be the young of a rather different looking fish of large size. Although no adults have been taken in the Atlantic this condition probably holds unless it could be shown that the Atlantic fishes never reach the mature condition of the Pacific forms and breed in what to them would be a juvenile stage. The figure is that of a supposed young fish from the Atlantic.

Reaches a length of 7 inches in our waters.

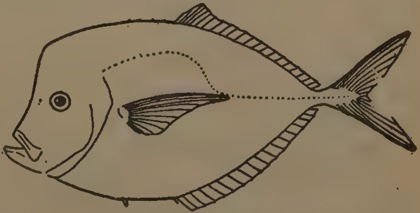
Cuban Jack *Hynnis cubensis* (Poey)

West Indies, north to the Florida Keys. La Monte, Pl. 15

A rather rare species.

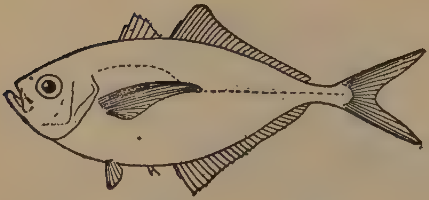
Reaches a length of about 3 feet.

Moonfish
Vomer setapinnis
(Mitchill)



Occurs from Brazil to Cape Cod, straggling to Nova Scotia. The young always common in the latitude of New York in the late summer and fall, presumably arriving via the Gulf Stream from their more southern spawning grounds.

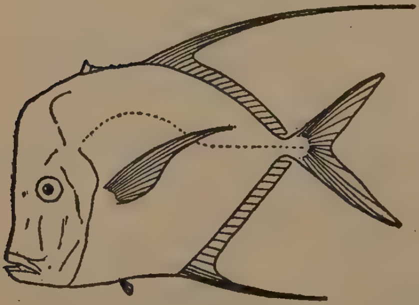
Reaches a length of about 12 inches.



Bumper

Chloroscombrus chrysurus (Linnæus)

Occurs from Brazil to Cape Cod.
Feeds mostly on plankton.
Reaches a length of about 10 inches.



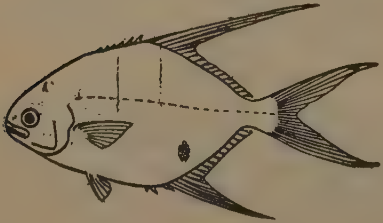
Look-down

Selene vomer (Linnæus)

Occurs from Brazil to Cape Cod, casually to Casco Bay.

The young are somewhat deeper than the adults and their ventral fins and the tips of the dorsal and anal are produced into filaments.

Reaches a length of about a foot.



Palometa

Trachinotus glaucus (Bloch)

Known from Virginia to Argentina.

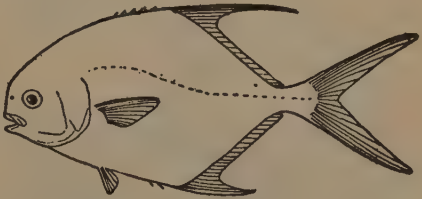
A fairly common species but not as favored a food fish as some of the other species of this genus.

Reaches a length of over a foot.

Round Pompano

Trachinotus falcatus (Linnæus)

LaMonte, PL. 14



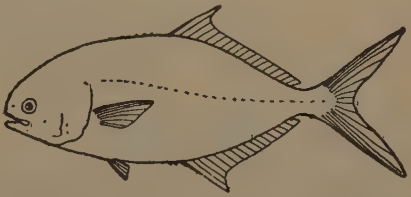
Occurs from Brazil to Cape Cod. Only young known in the northern part of their range, coming up on the Gulf Stream as do so many spring spawners of the West Indies.

Reaches a length of about 18 inches.

Great Pompano

Trachinotus goodei Jordan & Evermann

LaMonte, PL. 14

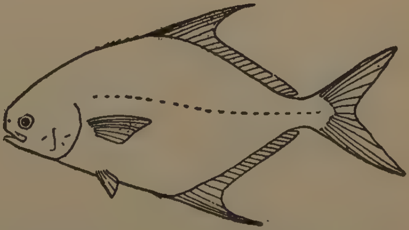


Occurs in the West Indies and Florida. Not common, but straggling to the north, as young, to Massachusetts.

Reaches a length of about 3 feet.

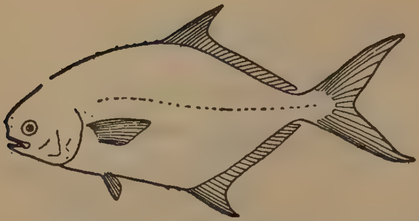
Silvery Pompano

Trachinotus argenteus Cuvier & Valenciennes



A rare West Indian form with a few records from Massachusetts.

Reaches a length of about 10 inches.



Common Pompano

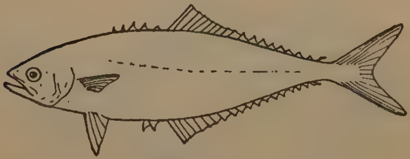
Trachinotus carolinus (Linnæus)

LaMonte, Pl. 14

Occurs on the south Atlantic and Gulf coasts from Cape Cod southward. Rare in the West Indies and Brazil. Only the young are common north of Virginia.

The much prized pompano of commerce.

Reaches a length of about 18 inches and a weight of about 2 pounds.



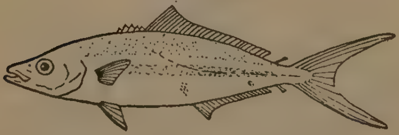
Leather-jacket

Oligoplites saurus (Bloch & Schneider)

Both coasts of tropical America, ranging north on our coast to New York and rarely to Massachusetts.

Feeds mostly on fishes.

Reaches a length of a little over a foot



Runner

Elagatis bipinnulatus (Quoy & Gaimard)

LaMonte, Pl. 13

Cosmopolitan in tropical seas, but rare in the West Indies and only reaching New York accidentally.

This brightly colored species, bluish above and yellow below, when young sometimes follows sharks.

Reaches a length of over 3 feet.

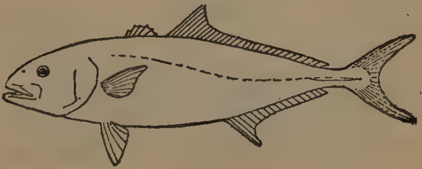
European Amber-jack *Seriola rivoliana* Cuvier & Valenciennes

Known from the West Indies, north to South Carolina. Also found in the Mediterranean.

Not common in our territory.

Reaches a length of about 2 feet.

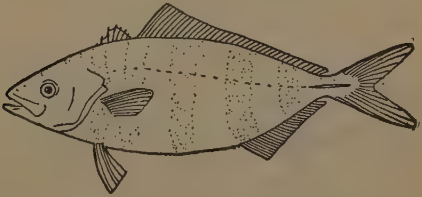
Great Amber-jack
Seriola dumerili
(Risso)



Occurs from Florida to Brazil, straggling north to New Jersey and rarely Massachusetts.

Reaches a length of 5 or 6 feet.

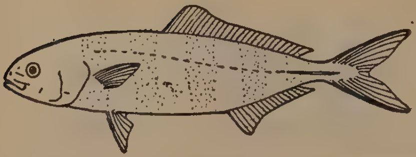
Banded Rudderfish
Seriola zonata
(Mitchill)



Occurs from Cape Cod southward to Hatteras and supposedly into the Gulf of Mexico.

When young this species is banded like the pilot fish but tends to loose these bands with age. They keep in companies following floating drift, small boats and large fish, chiefly sharks. The legend concerning this and the pilot fish leading sharks to food is of course erroneous. Most likely they follow such fish in order to be able to easily get "crumbs" when the latter feed. Such would be the inference, at least, judging from both field and aquarium observation.

Reaches a length of over two feet.



Pilot Fish

Naucrates ductor Linnæus

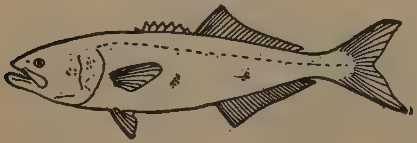
Cosmopolitan in all warm seas, well offshore, casually north to Maine on our coast.

This is the banded fish that often follows sharks and vessels well offshore. It is replaced in shore waters by the banded rudderfish which has rather similar habits.

Reaches a length of about 2 feet.

The Bluefishes—*Family Pomatomidæ*

This family is composed of a single species which was formerly supposed to be closely related to the pompanos. Now believed to be close to the sea basses on a basis of internal structure, only paralleling the mackerel-like fishes in external appearances. It is for the latter reason that it has been left in its old position.



Bluefish

Pomatomus saltatrix (Linnæus)

LaMonte, Pl. 17

Occurs in the warmer parts of the Atlantic and Indian Oceans. Not known north of Penobscot Bay. This species is well known to both the sea angler and the epicure. As a result many tons find their way to the table of man in the course of a year.

The quantities of bluefish in the north Atlantic fluctuate greatly from time to time, but on the whole have somewhat increased in historic times.

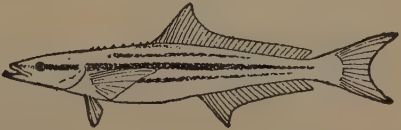
The eggs and larvæ are unknown, although the bluefish is known to spawn in the spring and early summer.

This species is exceedingly voracious, preying upon squids and fishes.

Reaches a weight of 10 pounds frequently. Recent records reach a weight of 27 pounds and a length of 45 inches. Old reports mention weights of up to 50 pounds.

The Cobias—*Family Rachycentridæ*

A family of rather uncertain position but evidently related to the mackerel-like forms. A single species is known.



Cobia
Rachycentron canadus
(Linnæus)
LaMonte, PL. 17

A well marked voracious species, cosmopolitan in warm seas. Not common on our coast north of Chesapeake Bay, but reaching Massachusetts as a straggler.

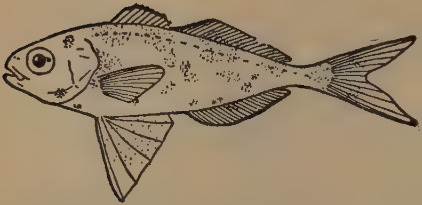
Feeds largely on fishes and crabs. On account of its predilection for the latter one of its local names is "Crab-eater." Most of the fishes it catches are bottom dwelling forms such as flounders, although it is known to, at least sometimes, catch swift fishes of open water such as weakfish.

Young specimens up to about 4 inches have the tail convex instead of lunate and propel themselves to a great extent by their large pectorals. Later in life the pectorals become relatively fixed in position and are used as little more than warping planes, somewhat as in a shark. In its youth the cobia bears a striking resemblance to the shark sucker and it has been suggested that they may be related but of this we are not certain at the present time.

Reaches a length of nearly 5 feet and a weight of over 60 pounds.

The Man-of-War Fishes—*Family Nomeidæ*

Small fishes usually of the open sea, sometimes drifting towards shore. A single species known in our area.



Man-of-war Fish

Nomeus gronovii (Gmelin)

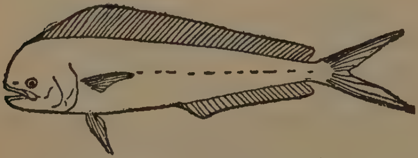
A small attractive fish to be usually found in company with the Portuguese man-of-war (*Physalia*). This large compound "jellyfish" drifts on the high seas of the tropics and is provided with long stinging tentacles that may be 30 feet or more in length and are certain death to most small organisms. Indeed they are capable of inflicting a painful injury to a human being. In the protection of these the man-of-war fish dwells with impunity, dodging about these dangerous tentacles when attack threatens. (See also harvest fish).

Cosmopolitan in warm seas drifting northward on our coast as far as Massachusetts.

Reaches a length of 8 inches.

The Dolphins—*Family Coryphænidæ*

A family of but two closely similar species, but one on our coast.



Dolphin

Coryphæna hippurus Linnæus

LaMonte, PL. 16

Cosmopolitan on the high seas, partial to blue water.

The dolphin is an exceedingly fast fish and feeds to a considerable extent on flying fish.

The "Dolphin" of Greeks was a mammal, one of the porpoises, and that of heraldry seems to have been a combination of this fish and the Greek "Dolphin".

The coloration of the dolphin is exceptionally vivid, being shot with blues and yellows which change rapidly under various circumstances.

Spawns in spring in the West Indies.
Reaches a length of 6 feet.

The Opahs—*Family Lampridæ*

A family of but one species occurring on our coast only as an accidental stray from the open sea.

It may be readily distinguished from related forms by the numerous ventral rays (14 to 17) instead of never more than 8.

Opah *Lampris luna* (Gmelin)

Known only as a straggler from the open seas. Records refer chiefly to the coast of Maine and northward although it has been taken near Cuba.

On the European coast where more frequently taken it is used for food.

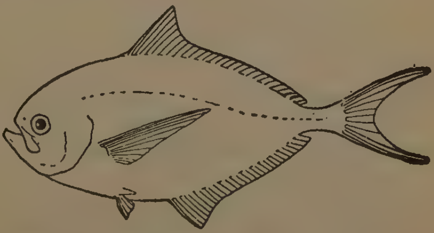
The body is a metallic silvery and gold color spotted with white and the fins are bright red.

Reaches up to 6 feet in length although usually little more than half of that.

The Pomfrets—*Family Bramidæ*

A family of open sea fishes, known from our coast by a single species as a rare straggler.

Pomfret
Brama raii
(Bloch)



Cosmopolitan, usually at considerable depth.
One record from No Man's Land, Massachusetts, in 1904.
Reaches a length of about 6 inches.

The Deep-water Pomfrets—*Family Steinegeriidæ*

A deep water family of a single species scarcely worthy of inclusion here.

Red Pomfret *Steinegeria rubescens* Jordan & Evermann

Known from the Pensacola Snapper Banks.

Bright red in life.

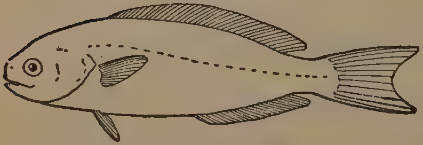
5 inches long.

The Rudder-fishes—*Family Centrolophidæ*

A family of open sea fishes rare on our coast.

A. Dorsal spines slender, graduated, joined by membrane; soft rays moderately elevated; head naked, its bones entire. *Black Ruff*, 146.

AA. Dorsal spines short and stout, membrane nearly obsolete, subequal, about as long as soft rays; the soft fins not falcate; sides of head scaly; preopercle, interopercle and subopercle finely serrate. *Black Rudder-fish*, 146.

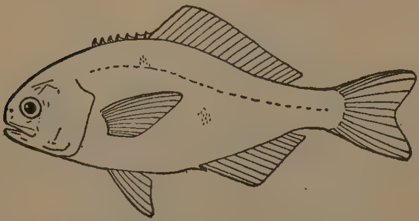


Black Ruff

Centrolophus niger (Gmelin)

Occurs off the coast of southern Europe, one record from our coast; off Massachusetts in 1888.

Reaches a length of about 1 foot.



Black Rudder-fish

Palinurichthys perciformis (Mitchill)

Occurs from Cape Hatteras to Nova Scotia. Most common south of Cape Cod. Casual in Great Britain.

Usually found under floating timber and weed.

Feeds on small fishes, squid, crustaceans, etc.

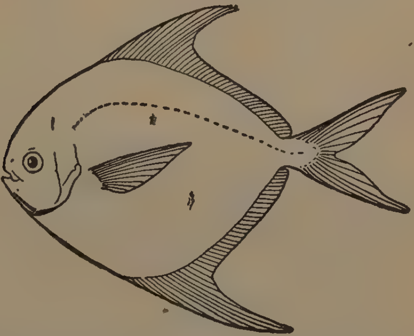
Reaches a length of nearly 14 inches and about 1¼ pounds in weight.

The Harvest Fishes—*Family Stromateidæ*

Small fishes of pelagic habit, mostly of warm seas.

A. Dorsal and anal fins very high in front, the anterior lobe falcate; body suborbicular; no row of pores on back; anal rays III, 43. *Harvest Fish*, 147.

AA. Dorsal and anal fins moderately elevated in front, scarcely falcate, body not suborbicular, a row of pores on back above lateral line; anal rays III, 37. *Butterfish*, 147.

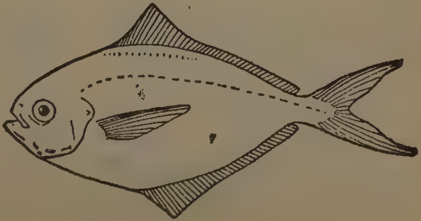


Harvest Fish
Peprilus alepidotus
(Linnæus)

Known from Cape Cod to Brazil. In the northern part of its range the harvest fish is very variable in quantity from year to year, but is never common north of New Jersey.

The young are sometimes taken in company with the man-of-war fish (which see) beneath the dangerous tentacles of the Portuguese man-of-war. The adults are often found in company with the butterfish.

Reaches a length of 11 inches, although usually not much over 8.



Butterfish
Poronotus tricanthus
(Peck)

Known from Nova Scotia to Cape Hatteras and in deep water to Florida. Its abundance increases northward somewhat as the abundance of the harvest fish decreases.

The food consists mainly of the smaller plankton organisms, but the larger examples catch young fish and squid.

In the northern part of this range, at least Massachusetts, spawning takes place in June and July. The eggs are pelagic and average about 0.75 mm. in diameter. They possess a single oil globule and are highly transparent. At 72° F. they hatch in somewhat less than two days. The newiy hatched fish are about 2 mm. long. On attaining a length of 20 mm. the general appearance of the adult has been attained.

The young sometimes seek the shelter of the larger Medusæ as the young harvest fish seek that of the Portuguese man-of-war.

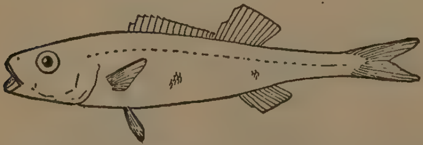
Within the last two decades the butterfish has reached a fair market value, whereas formerly they were considered scrap fish and it was customary for fishmongers about New York to throw one in a purchase for the family cat in a manner similar to the baker that always gave a cookie to the child purchaser or the druggist a stick of licorice root.

Butterfish are sometimes marred for table use by the frequent infestation of encystation of cestode parasites in the flesh.

A length of 12 inches is reached by this species, but usually they are not over 9.

The Square Tails—*Family Tetragonuridæ*

A family of but one species. Probably related to the scombroid fishes.



Square Tail

Tetragonurus cuvieri
Risso

Occurs off southern France and the Madeira Islands. Rare on our coast at Massachusetts.

Reaches a length of about 3 inches.

THE PERCH-LIKE FISHES—*Suborder Perçoidea*

A large diversified group of fishes representing the dominant type of fish life today. The typical spiny-rayed fishes.

A. Maxillary not sheathed by the preorbital, or only partly covered by the edge of the latter; pectoral fin without an accessory scale at its base; ventral with a very small one or none; sheath at base of spinous dorsal little developed; vomer usually with teeth; opercle usually ending in a spine.

B. Anal spines usually more than 3; body usually deep and compressed (fresh-water fishes). *The Sunfishes*, 150.

BB. Anal spines 3 or less; body various.

C. Anal spines 1 or 2 (rarely 3).

D. Body elongate; anal spines 1 or 2; color not red (fresh-water fishes). *The Perches*, 151.

DD. Body not elongate; anal spines 2 (rarely 3); color red. *The Cardinal Fishes*, 152.

CC. Anal spines 3 or none, never 1 or 2.

E. Vomer and usually palatines also with teeth.

F. Lateral line strongly marked, extending to end of caudal fin; body elongate; teeth small, upper profile of head concave. *The Snooks*, 153.

FF. Lateral line not extending onto caudal fin.

G. Anal fin shorter than dorsal; head not everywhere covered with rough scales; postocular part of head not shortened. *The Sea Basses*, 154.

GG. Anal fin scarcely shorter than dorsal and similar to it; head and body everywhere covered with rough scales; body deep compressed; color chiefly red. *The Big-eyes*, 167.

EE. Vomer without teeth; dorsal fin continuous; body deep, compressed. *The Triple-tails*, 176.

AA. Maxillary slipping for most of its length under the edge of the preorbital, which forms a more or less distinct sheath; ventrals with an accessory scale; opercles without spines; anal spines 3, rarely 1 or 2.

H. Anal with 3 spines; lateral line not extending onto caudal fin.

I. Intestinal canal short; carnivorous species; teeth in jaws not all incisor-like.

J. Spines of premaxillary not greatly produced so as to slide in a long groove up between the eyes; mouth moderately protractile.

K. Vomer with teeth; teeth in jaws usually unequal; some of them more or less canine-like. *The Snappers*, 168.

KK. Vomer without teeth; palatines and tongue toothless.

L. Teeth on sides of jaws not molar. *The Grunts*, 174.

LL. Teeth on sides of jaws molar like, anterior teeth conical or incisor-like. *The Porgys*, 180.

JJ. Spines of premaxillary greatly produced, sliding in a groove up to between eyes; mouth excessively protractile. *The Mojarras*, 186.

II. Intestinal canal long; herbivorous species; anterior teeth of jaws incisor-like; no molars or canines. *The Chubs*, 188.

HH. Anal with 1 or 2 species; lateral line extending to end of caudal fin. *The Croakers*, 189.

The Sunfishes—*Family Centrarchidæ*

Fresh water fishes, usually deep and compressed of body with 6 to 13 dorsal spines and 3 to 8 anal spines, with the soft parts of these fins somewhat lobate. Rarely taken in brackish water.

A. Anal fin somewhat longer than dorsal, with 6 spines; body and fins profusely spotted with irregular black marks. *Crappie*, 151.

AA. Anal fin much shorter than dorsal, with 3 spines.

B. Body comparatively short, deep, strongly compressed, the depth frequently half the length, always exceeding ⅓ of the length; dorsal fin continuous, scarcely or not at all notched at beginning of soft rays.

C. Caudal fin rounded; opercle without a flap ending in 2 flat points; 9 dorsal spines; size small. *Blue-spotted Sunfish*, 151.

CC. Caudal fin emarginate, never rounded; opercle with a large black flap in adult on which is a small red spot; dorsal with 10 spines; size larger. *Common Sunfish*, 151.

BB. Body elongate, not strongly compressed, the depth rarely as great as ⅓ the length; dorsal fin deeply notched; mouth large; maxillary reaching opposite middle of eye at least.

D. Mouth moderate; maxillary reaching to or a little beyond middle of eye; scales rather small 69 to 72; 10 between lateral line and origin of soft dorsal; color nearly uniform (young more or less barred and spotted). *Small-mouth Black Bass*, 151.

DD. Mouth very large; maxillary reaching to or beyond posterior margin of eye; scales larger 61 to 64: 7 or 8 between lateral line and origin of soft dorsal; a distinct black lateral band usually present, sometimes absent in adults. *Large-mouth Black Bass*, 151.

Crappie *Pomoxis annularis* Rafinesque

A fresh water species introduced on the Atlantic slope by the agency of man. A single record of it in brackish water in the Chesapeake Bay region. LaMonte, Pl. 63

Reaches a length of about 12 inches.

Blue-spotted Sunfish *Enneacanthus gloriosus* (Holbrook)

A small fresh water sunfish ranging from New York to Georgia. Recorded from slightly brackish water entering Chesapeake Bay.

Reaches a length of a little over 3 inches.

Common Sunfish *Eupomotis gibbosus* (Linnæus)

A fresh water species ranging from Maine to Florida only occasionally entering brackish water.

Reaches a length of about 10 inches. LaMonte, Pl. 60

Small-mouth Black Bass *Micropterus dolomieu* (Lacépède)

A fresh water species ranging from Vermont to Mississippi and rarely entering the brackish water of Chesapeake Bay.

Reaches a length of a little over 2 feet. LaMonte, Pl. 58

Large-mouth Black Bass *Micropterus salmoides* (Lacépède)

A fresh water species ranging from Canada to Mexico and rarely entering brackish water. LaMonte, Pl. 58

Reaches a length of nearly 3 feet.

The Perches—*Family Percidæ*

Fresh water fishes with distinctly separate dorsal fins and rather elongate bodies. But two species enter tide water in our range.

A. Branchiostegals 7; preopercle serrate; body yellowish with dark vertical bars. *Yellow Perch*, 152.

AA. Branchiostegals 6; preopercle entire; body olivaceous with dark irregular marks. *Johnny Darter*, 152.

Yellow Perch *Perca flavescens* (Mitchill)

Fresh waters from Nova Scotia to North Carolina occasionally entering brackish water but not very often or very far from the fresh water limit.

Reaches usually less than a foot in length.

Johnny Darter *Boleosoma olmstedi* (Storer)

Coastwise streams from Massachusetts to North Carolina, recorded from streams entering Chesapeake Bay in brackish water.

Reaches a length of about 3 inches.

The Cardinal Fishes—*Family Cheilodipteridæ*

Small tropical fishes usually bright red in color.

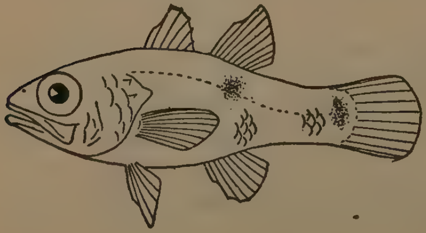
Fishes of this family are much given to secreting themselves in the hollows provided by the living shells of large mollusks and other similar places. Likely they are all more or less addicted to the habit. Also some are known to carry their eggs in their mouths for purposes of incubation. This also may be common to all of them.

A. Preopercle with its posterior edge distinctly serrate, at least in the young; scales about 26, a roundish blotch at the base of the soft dorsal. *Spotted Cardinal Fish*, 152.

AA. Preopercle with its ridges entire at all ages, scales 21 to 23.

B. Ventrals short, not reaching vent; dorsal VI–I. 9. *Pensacola Cardinal Fish*, 153.

BB. Ventrals long, extending beyond anal; dorsal VII–I, 9. *Conchfish*, 153.



Spotted Cardinal Fish

Amia maculatus (Poey)

West Indian, from Florida to Brazil, straggling northward to Massachusetts.

The coloration of this fish is essentially bright red with the exception of the blotch mentioned in the key.

Reaches a length of 4 or 5 inches.

Pensacola Cardinal Fish *Apogonichthys alutus* (Jordan & Swain)

Known chiefly from the Pensacola snapper banks in deep water.

Reaches a length of a few inches.

Conchfish *Apogonichthys stellatus* Cope

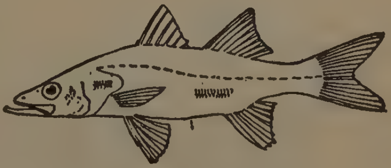
Known from the West Indies north to the Florida Keys.

This fish lives within the mantel cavity of the conch (*Strombus gigas*) which is used for food at Key West. Consequently specimens are inadvertently brought into market from time to time. They apparently use the conch for shelter only. Their food is largely small crustaceans. They are also taken in sponges and other cavities.

Reaches a length of about 2 inches.

The Snooks—*Family Centropomidæ*

A family of typical acanthopterygians with long concave snouts; usually silvery in general color. Tropical fishes. One species in our range.



Snook
Centropomis undecimalis
(Bloch)
LaMonte, PL. 18

West Indies. In our range from Texas to Florida.

A food fish of some importance. One of the most palatable of fishes.

Tends somewhat to run into fresh waters.

Reaches a length of 4 feet although usually smaller.

The Sea Basses—*Family Serranidæ*

A large and diversified family of spiny rayed fishes. This family and its allies form the dominant group of marine fishes today. They are all carnivorous and the larger members are valued as food wherever found.

A. Anal spines 3, well developed.

B. Dorsal fins 2.

C. Anal III, 12; sides with longitudinal stripes. *Striped Bass*, 157.

CC. Anal III, 9; sides plain dusky silver. *White Perch*, 158.

BB. Dorsal fin single, but sometimes deeply divided.

D. Ventral fins inserted a little behind base of pectorals.

E. Inner teeth of jaws not depressible or hinged; head armed with rough crests. *Wreckfish*, 159.

EE. Inner teeth of jaws depressible or hinged; head not armed with rough crests.

F. Dorsal notched; maxillary with a distinct supplemental bone.

G. Dorsal normally with 9 spines.

H. Dorsal IX, 15 to 17; anal III, 9; gill-rakers 12 to 14 on lower limb of first arch. *Coney*, 159.

HH. Dorsal IX, 14; anal III, 8; gill-rakers 9 or 10. *Graysby*, 159.

GG. Dorsal normally with 10 or 11 spines.

I. Anal fin with 11 or 12 soft rays.

J. Nostrils subequal, well separated.

K. Angle of preopercle not salient, its teeth scarcely enlarged; gill-rakers 10 + 8 to 10.

L. Gill-rakers 10 + 8; scales about 125; general color pale, bright red or grayish with darker round spots. *Yellow-fin Grouper*, 160.

LL. Gill-rakers 10 + 10; scales about 110; color dark olive green with large dark rather quadrate blotches. *Black Grouper*, 160.

KK. Angle of preopercle more or less salient; its teeth somewhat enlarged; gill-rakers 10 + 12 to 14.

M. Scales about 140; commissure without yellow; body uniformly colored. *Gag*, 161.

MM. Scales about 120; commissure with yellow-green, body boldly spotted. *Princess Rockfish*, 161.

JJ. Nostrils very close together, the posterior definitely the larger and with a distinct septum within. *Scamp*, 161.

N. Outer caudal and anal rays much produced; body marbled.

NN. Outer caudal and anal rays not produced; body with diagonal light stripes separating a groundwork of round spots. *Tiger Rockfish*, 161.

II. Anal fin with 7 or 8 soft rays.

O. Body not especially deep, more than 2.5; head large, less than 3.0.

P. Scales of lateral line each with 4 to 6 strong radiating ridges; head broad, depressed between the eyes. *Spotted Jewfish*, 162.

PP. Scales of lateral line normal, with radiating striæ; head narrow, not depressed between the eyes.

Q. Head compressed; interorbital area rather narrow, usually less than diameter of eye, dorsal spines 11.

R. Second dorsal spine nearly as long as the third, the posterior spines not noticeably reduced in length; caudal fin with straight or concave margin; color nearly uniform brownish; sides with indistinct pale pale blotches; several well-defined dark dots around eye. *Red Grouper*, 162.

RR. Second dorsal spine notably shorter than the third, the posterior spines more or less reduced in length; caudal fin rounded.

S. Maxillary scaleless, body covered with red or orange spots, vertical fins without dark edgings. *Rock Hind*, 162.

SS. Maxillary more or less scaley.

T. Preopercle with a more or less distinct salient angle which is armed with larger teeth (sometimes undeveloped in the *Nassau grouper*, but which always has black points about the eyes).

U. Body without orange or dark-brown spots, the spots (if any) brownish or pearly, diffuse or irregular; vertical fins without broad black margin.

V. Caudal peduncle without a black saddle-like blotch above; dorsal with a bright yellow edging, color or body uniform reddish brown. *Poey's Grouper*, 163.

VV. Caudal peduncle with a large quadrate saddle-like blotch above (sometimes wanting in the young of the *snowy grouper.*)

W. Eye not surrounded by dark points, sides brown, marked by large blotches of steel blue, no dark cross bars. *Snowy Grouper*, 163.

WW. Eye surrounded by conspicuous dark-brown points, body with irregular dark cross bars. *Nassau Grouper*, 163.

UU. Body covered with small dark orange or brown spots, vertical fins broadly edged with blue black. *Red Hind*, 163.

TT. Preopercle without salient angle; body, head and fins dark reddish brown, profusely covered with small pearly-white stellate spots. *Speckled Hind*, 163.

QQ. Head comparatively broad, interorbital area notably wider than eye, dorsal spines 10 or 11, maxillary scaley, scales 86 to 110; dorsal fin rather deeply notched. *Black Jewfish*, 164.

OO. Body deep, about 2.5; head small about 3.0.

X. Branchiostegals 8; dorsal arch little more arched than ventral. *Sickle-finned Grouper*, 164.

XX. Branchiostegals 7; dorsal arch much greater than ventral. *Marbled Grouper*, 164.

FF. Dorsal weakly or not at all notched; maxillary without a supplemental bone, body short and deep; top of head naked, dorsal usually X, 14. *Butter Hamlet*, 164.

DD. Ventral fins inserted more or less in advance of pectoral.

Y. Gill-rakers comparatively short and wide set, lateral line not running close to back; dorsal X, 11 to 15.

Z. Caudal fin ending in 3 points, the middle rays being produced; dorsal X, 11.

A′. Dorsal spines with dermal flaps, projecting scarcely to top of their spines; longest dorsal spine less than half head.

B′. Caudal fin with its angles little produced, the longest ray not exserted for a distance equal to fin; color dusky brown or black with paler longitudinal streaks (young with a black longitudinal band), many dark cross shades and a large black spot on last dorsal spines. *Common Sea Bass*, 165.

BB′. Caudal fin with its upper and lower lobes filamentous much produced, the middle rays still longer; color grayish, each side with 3 longitudinal rows of quadrate black blotches, the upper series somewhat obscure; jet-black spots on middle caudal rays. *Gulf Sea Bass*, 165.

AA′. Dorsal spines, in part at least, with fleshy filaments which are exserted considerably beyond the tips of the spines; largest dorsal spine about half head; color olive gray with about 7 broad diffuse brown bars extending from back obliquely forward to level of pectorals. *Rock Sea Bass*, 166.

ZZ. Caudal fin lunate or truncate; dorsal X, 11 to X, 13.

C′. Branchiostegals 7; caudal fin forked or lunate; none of the dorsal spines elongate.

D′. Preopercle with numerous strong diverging spines at its angle; these spines diverging from 2 centers; preorbital broader than maxillary which is widest near its middle, scales 180 to 90. *Sand Fish*, 166.

DD′. Preopercle simply and rather finely serrate; preorbital narrow; scales about 53. *Phœbe*, 166.

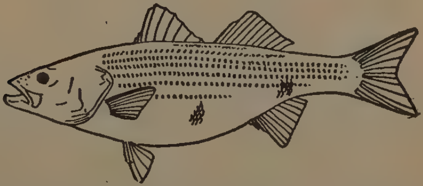
CC′. Branchiostegals 6; caudal fin truncate; scales about 42. *Belted Sandfish*, 166.

YY. Gill-rakers long, slender and close-set; lateral line running close to the back, dorsal X, 14, scales 50 to 60. *Red Barbier*, 166.

AA. Anal spines wanting; dorsal spines 2 to 4; soft dorsal and anal long.

E′. Opercular spines 3, all well developed; depth of body 3 to 3½; color dusky brown, fins marked with blackish with pale edges usually. *Three-spined Soapfish*, 166.

EE′. Opercular spines 2, only the upper being well developed and that small; depth of body 2.33 to 2.66; color dusky olive-brown, fins not pale edged. *Two-spined Soapfish*, 166.



Striped Bass

Roccus lineatus (Bloch)

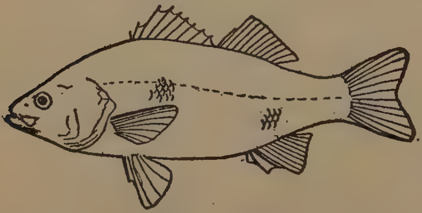
LaMonte, Pl. 18

Indigenous from the Gulf of St. Lawrence to Florida, most common between Cape Cod and Cape May. Has been successfully introduced on the Pacific, where it now is of considerable importance. This is one of the few cases that we know of where introduced animals have apparently not considerably upset the balance of life.

The striped bass ascends rivers, or at least enters bays for the purpose of spawning, and as a consequence has suffered considerably from the heavy pollution of its breeding grounds and due to its necessarily high concentration in contracted bodies of water has been caught in probably excessively great numbers. In the more southern part of its range it begins spawning in May. The eggs are non-adhesive and sink slowly in fresh or mildly brackish water and probably constantly drift about during incubation. The eggs average 3.5 mm. in diameter and hatch in about 3 days at a temperature of 58° F. The maximum number recorded for a female is 2,200,000 although doubtless this is greatly exceeded by very large fish.

The food consists largely of fish and the larger crustaceans, including crabs and lobsters.

Reaches a weight of 125 pounds. This size is unusual, however. In the latitude of New York, at least, examples of over 70 pounds are unusual.



White Perch

Morone americana (Gmelin)

LaMonte, Pl. 64

Occurs on the Atlantic coast from Nova Scotia to South Carolina in both fresh and salt water.

It is a permanent resident within its range, congregating in a more or less sluggish condition in the colder months.

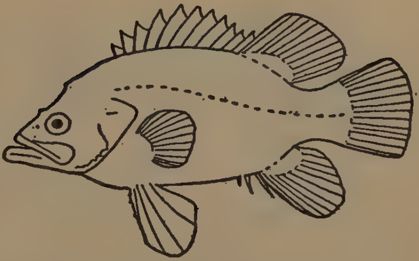
It spawns from April to June, depending on the latitude. The eggs are heavy and adhesive and average about 7.5 mm. in diameter. They hatch in about three days at a temperature of 58° F. A fair-sized female will deposit about 40,000 eggs. The spawning grounds are usually either fresh or brackish ponds. Under land-locked conditions they continue to reproduce but usually each successive generation is smaller and less vital than the last. It seems that recourse to salt water is necessary to their best development.

The food of the white perch consists chiefly of small crustaceans.

A size of about 15 inches is reached, with a weight of 2 or 3 pounds.

Wreckfish

Polyprion americanus (Bloch & Schneider)



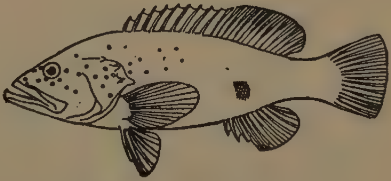
Known from both coasts of the temperate Atlantic.

The adults, however, are not uncommon in waters of over 300 fathoms, although rare in our range. The name is derived from the belief that they are usually found about wrecks. The young swim near the surface.

Reaches a length of 5 or 6 feet.

Coney

Cephalopholis fulvus (Linnæus)



Known from Florida to Bahia.

A common West Indian species which has been divided into a number of varieties. Only the form called *Cephalopholis fulvus punctatus* (Linnæus) occurs in our range.

Feeds largely on crustaceans.

Reaches a length of about 1 foot.

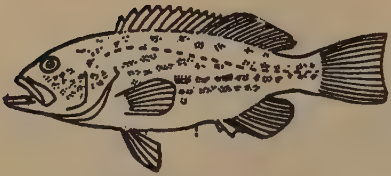
Graysby *Petrometopon cruentatus* (Lacépède)

Known from the Florida Keys to Brazil.

Although small, this species is a food fish of some importance.

Like many of the more tropical members of this family, the Graysby is capable of considerable change of color.

Reaches a length of about 1 foot.



Yellow-fin Grouper

Mycteroperca venenosa (Linnæus)

LaMonte, PL. 21

West Indies north to the Florida Keys. Recorded as far north as North Carolina.

This handsome grouper appears to be divisable into two races on a basis of color only, the one inhabiting shore waters and the other comparatively deep places. Intermediates in color do not seem to be known. They may be separated as below.

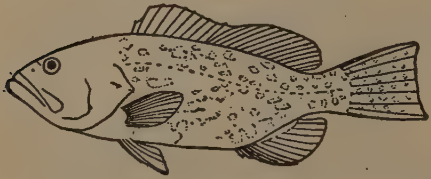
A. General color gray with red and black markings. *M. v. venenosa* (Linnæus)
(The shore form.)

AA. General color scarlet with red and black markings. *M. v. apua* (Bioch).
(The deep water form.)

The shore form is common about rocky places. It is quite possible that these two forms which have been variously recognized as species and sub-species are merely color variants of the same thing associated with differences in environment.

The flesh of this species is reported to be poisonous at times.

Reaches a length of about 3 feet.



Black Grouper

Mycteroperca bonaci (Poey)

LaMonte, PL. 21

A West Indian species, occurring from Florida to Brazil and straggling northward to Massachusetts. Abundant about the Florida Keys.

This species, like the preceding one, has a deep and shallow water color form of questionable relationship. They may be distinguished by the following.

A. Dark blotches on body rather large, tending to be quadrate, not deep orange-bronze.
M. b. bonaci (Poey)
(The Shore form.)

AA. Dark spots on body very small, close-set and of a deep bronze orange.
M. b. xanthasticta (Jordan & Swain)
(The deep water form.)

The deep water form is rare and probably hardly ever enters our area proper.

Reaches a length of about 3 feet and a weight of 50 pounds.

Gag *Mycteroperca microlepis* (Goode & Bean)

South Atlantic and Gulf coasts north to North Carolina.

This species is either rare or absent in the West Indies, but abundant about the Florida reefs, where it is an important food fish.

Reaches a length of about 3 feet and a weight of 50 pounds.

Princess Rockfish *Mycteroperca interstitialis* (Poey)

West Indies occasionally north to the Florida Keys. Once questionably recorded from Massachusetts.

One of the most handsome species of the genus, subject to many elegant color phases.

Reaches a length of about a foot.

Scamp *Mycteroperca falcata* (Poey)

Represented in Florida waters by a form slightly different than the typical West Indian fish. The two may be separated according to the following.

A. Upper canines directed strongly forward, the lower backward; coloration obscure. *M. f. falcata* (Poey)
(The West Indian form.)

AA. Upper canines nearly vertical; coloration rather pale but bright. *M. f. phenax* (Jordan & Swain)
(The Florida form.)

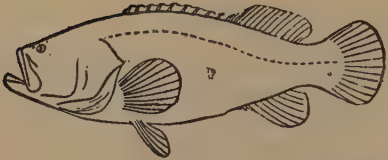
Abundant about the Florida Keys.

Reaches a length of about 2 feet.

Tiger Rockfish *Mycteroperca tigris* (Cuvier & Valenciennes)

A West Indian form, rarely reaching the Florida Keys.

Reaches a length of about 2 feet.



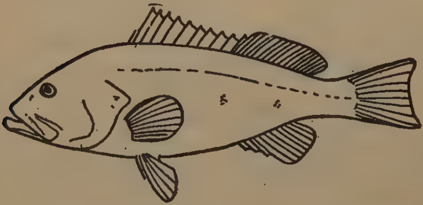
Spotted Jewfish
Promicrops itaiara
(Lichtenstein)
LaMonte, Pl. 19

Known from both coasts of tropical America, north in the Atlantic to Florida.

The largest of our sea basses, formerly unsaleable in Florida markets, but now highly valued. Although its large size has attracted anglers, its sluggish habits make it unsuitable as a truly "game" fish.

Specimens under 3 feet in length appear to be immature.

Reaches a length of 8 feet and a weight of 693 pounds.

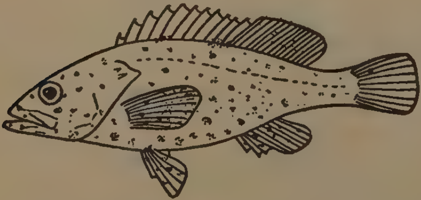


Red Grouper
Epenephelus morio (Cuvier & Valenciennes)
LaMonte, Pl. 22

Known from Virginia to Rio de Janeiro, straggling northward to Massachusetts as young.

Probably the most abundant species of this genus and consequently the most important economically.

Reaches a length of about 3 feet.



Rock Hind
Epinephelus adscensionis
(Osbeck)
LaMonte, Pl. 2

A West Indian species straggling northward to Massachusetts.

A valued food fish of the tropics.

Reaches a length of about 16 inches.

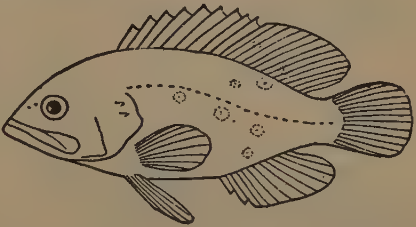
Poey's Grouper *Epinephelus flavolimbatus* Poey

A little known West Indian form sometimes taken on the Pensacola snapper banks.

This may be the adult of the snowy grouper.

Snowy Grouper

Epinephelus niveatus (Cuvier & Valenciennes)



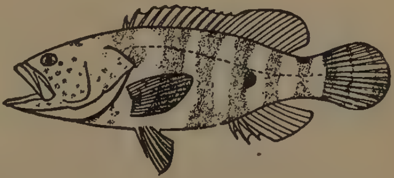
A West Indian species reaching from Brazil to occasionally northward to Massachusetts.

Reaches a length of about 2 feet.

Nassau Grouper

Epinephelus striatus (Bloch)

LaMonte, PL. 21



Known from Florida to Brazil. Recorded as far north as North Carolina.

A common West Indian species, easily recognized by its distinctive pattern.

A good food fish, valued wherever found.

Reaches a length of about 3 feet.

Red Hind *Epinephelus guttatus* (Linnæus)

Known from South Carolina to Brazil.

Feeds mostly on fishes.

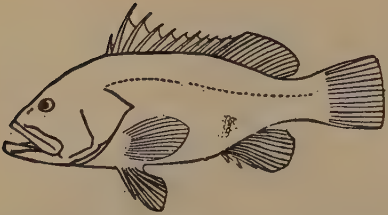
Reaches a length of about 1½ feet.

Speckled Hind *Epinephelus drummond-hayi* Goode & Bean

Gulf of Mexico north to South Carolina.

A food fish of some importance off Pensacola.

Reaches a weight of 30 pounds.



Black Jewfish
Garrupa nigrita
(Holbrook)
LaMonte, Pl. 23

Known from South Carolina to Brazil. Not uncommon off Florida and in the Gulf of Mexico.

Rivals the spotted jewfish in size. Probably reaches a length of about 6 feet and a weight of 500 pounds. Small examples are not commonly found.

Sickle-finned Grouper *Dermatolepis zanclus* Evermann & Kendall

Known from Key West, Florida, from a single specimen. Possibly identical with the following species.

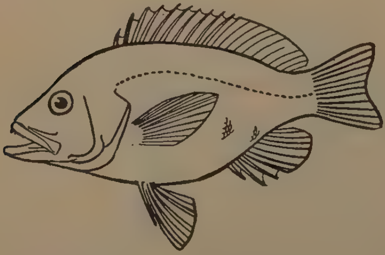
Twenty inches long.

Marbled Grouper *Dermatolepis marmoratus* Osburn & Mowbray

Known from Key West, Florida, only. Rare, the local fishermen having no name for it.

Usually taken in rather deep water.

Reaches a little over 2 feet in length.



Butter Hamlet
Hypoplectrurus unicolor
(Walbaum)

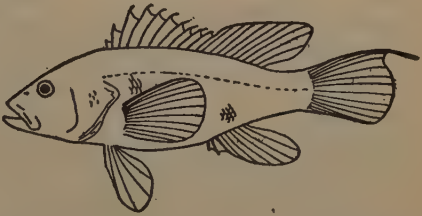
Known from the West Indies, north to the Florida Keys. This species has been split into very many subspecies, the true status of which are exceedingly involved and difficult to determine. Some may be of true specific rank and many are certainly mere individual color phases. In the present confused status of this species it would be unwise to attempt to prepare a key for subspecific differentiation for our purposes here.

Common in localities which are generally rocky.

Feeds largely on crustaceans and fishes.

Reaches a length of about 1 foot.

Common Sea Bass
Centropristus striatus
(Linnæus)



Known from northern Florida to Cape Ann, straggling to Maine. Most common between Cape Cod and Cape Hatteras.

Spawns from May to July, dependent on latitude. The eggs are buoyant, non-adhesive and average about 1 mm. in diameter. At a temperature of 50° F. they hatch in about 5 days.

The sexes are somewhat different in appearance, the fin rays being notably longer in the male.

The sea bass feeds largely on fish, squid and crabs.

The adults tend to keep well offshore and in a few fathoms over rocky bottoms. The young and half grown are apt to be in shallow bays.

Reaches a length of 18 inches and a weight of 3 pounds, although records reach up to 8 pounds 2 ounces.

Gulf Sea Bass *Centropristes ocyurus* (Jordan & Evermann)

Gulf of Mexico in rather deep water east to Florida.

This species strongly resembles the very young of the common sea bass.

Reaches a length of at least 1 foot.

Rock Sea Bass *Centropristes philadelphicus* (Linnæus)

Known from South Carolina.
Not rare about rocky shores.
The sexes are quite similar in appearance.
Probably reaches a length of about a foot.

Sand Fish *Diplectrum formosum* (Linnæus)

Known from North Carolina to Uruguay. A common shore fish from South Carolina to Texas.

Although small, it is a good food fish.

Reaches a length of about a foot.

Phœbe *Prionodes phœbe* (Poey)

Known from the West Indies north to Florida.
Not rare from the Pensacola snapper banks.
Reaches a length of 8 inches.

Belted Sand Fish *Dules subligarius* (Cope)

Known from Florida to North Carolina.

Usually taken in deep water, but sometimes young are found close to shore in sea-wrack.

Reaches about 6 inches in length.

Red Barbier *Hemianthias vivanus* (Jordan & Swain)

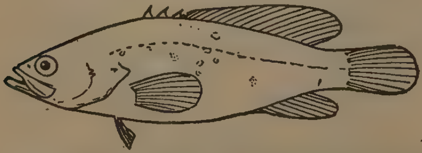
Gulf of Mexico, in deep water, usually outside of our range.
An unusually handsomely colored species.
Reaches a length of about 8 inches.

Three-spined Soapfish *Rypticus saponaceus* (Bloch & Schneider)

Known from Florida to Brazil, also from West Africa.

The name is derived from the excessive amount of soap-suds-like mucous they exude when handled.

Reaches a length of about a foot.



Two-spined Soapfish

Rypticus bistrispenus (Mitchill)

A West Indian species usually in fairly deep water, regularly reaching South Carolina and accidentally to Rhode Island.

Reaches a length of about 1 foot.

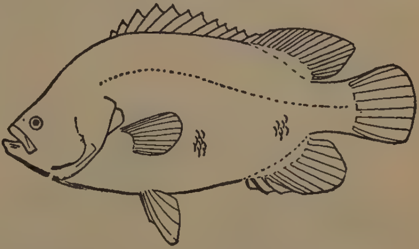
The Triple-tails—*Family Lobotidæ*

Large fishes with rather produced anal and dorsal fins from which the common name is derived. A single species in the Atlantic.

Triple-tail

Lobotes surinamensis (Bloch)

LaMonte, Pl. 23



Common in the warmer part of our range reaching north to Cape Cod.

Although the adults are nearly uniform black the young may be variously colored, often being tan or even yellowish and sometimes mottled.

A food fish of some importance.

Feeds largely on fishes.

Reaches a length of 3 feet.

The Big-eyes—*Family Priacanthidæ*

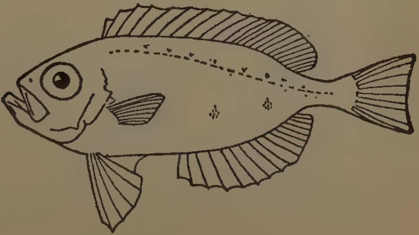
Deep bodied, compressed fishes with all parts of the bodies scaled. Carnivorous fishes of tropical seas, usually in rather deep water. Chiefly deep red in color.

A. Scales 98 to 115; body depth 2.75 to 3.2; preopercle with a flat spine; dorsal and anal each with 14 or 15 soft rays. *Common Big-eye*, 167.

AA. Scales about 37; body depth 2.1; preopercle with no spines; dorsal and anal each with 9 to 11 soft rays. *Deep Big-eye*, 168.

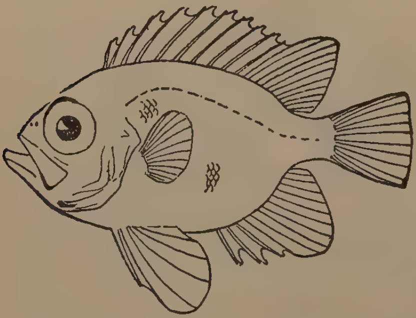
Common Big-eye

Priacanthus arenatus Cuvier & Valenciennes



A West Indian species, extending from Brazil northward, in the case of the young, to Massachusetts.

When swimming in shallow water, as in an aquarium, in a bright light, the large eye so intercepts the light as to reflect it upward in beams. If viewed from above, especially in slightly turbid water, shafts of light strike upward to the surface like the beams of miniature searchlights.



Deep Big-eye
Pseudopriacanthus altus
(Gill)

A West Indian species regularly occurring north to South Carolina, the young straying northward to Massachusetts. The brilliant red and flat almost circular outline of the young make them impossible to mistake.

Reaches a length of about 11 inches.

The Snappers—*Family Lutianidæ*

Usually large tropical fishes valued for food. They have large mouths well armed with sharp teeth in the jaws, and on the palatines and tongue.

A. No pterygoid teeth, dorsal spines 10 or 11; vomerine teeth in an anchor-shaped or V-shaped patch.

B. Gill-rakers few and short, less than 12 on lower limb of first arch, the caudal lobes not especially produced in the adults.

C. Anal fin with 7 to 9 rays, caudal fin emarginate or slightly forked.

D. Soft dorsal normally with 14 rays, rarely 13.

E. Anal fin rounded, its middle rays less than half head, no black lateral spot.

F. Developed gill-rakers 7 to 9, usually with a few rudiments, caudal lunate; vomerine teeth forming an anchor-shaped patch, with a distinct backward prolongation on the median line; second anal spine little, if any, shorter than third; upper canines strong, lower moderate or small.

G. Body comparatively elongate, the depth 2.75 to 3; maxillary about 2.5 in head; scales 7–50–12; pectoral less than ⅔ of head; soft dorsal and anal blackish, body greenish. *Gray Snapper*, 170.

GG. Body comparatively deep, about 2.5; maxillary about 3 in. head; pectorals more than ⅔ of head, soft dorsal and anal orange or yellow.

H. Scales 8–56–15, a whitish area below eye, a blue streak along suborbital region usually not disappearing with age. *Dog Snapper*, 170.

HH. Scales 6–44–13, no whitish area below eye, a blue streak along suborbital impermanent. *Schoolmaster*, 171.

FF. Developed gill-rakers more numerous, about 10, with several rudiments before them; caudal moderately forked; scales 8–63–15, color crimson. *Black-finned Snapper*, 171.

EE. Anal fin angulated, its median rays produced, at least half head (in adult), color more or less red, the young with a black lateral blotch.

I. Color of body definitely red, vomerine teeth in an anchor-shaped patch, with a median backward prolongation.

J. Head 2.77 to 2.80, eye about 6.75; 9 developed gill-rakers on lower limb of first arch; scales 7–58 to 63–14, 9 soft rays in anal. *Pensacola Red Snapper*, 171.

JJ. Head 3, 11, eye about 5.4; 11 developed gill-rakers on lower limb of first arch; scales 8–69–15; 8 soft rays in anal. *Caribbean Red Snapper*, 172.

II. Color of body above, dark olive green with pale blue spots, belly white or reddish, all fins reddish; vomerine teeth lacking the median backward prolongation. *Muttonfish*, 172.

DD. Soft dorsal with 12 rays, rarely 13.

K. Mouth moderate, maxillary 2.6 to 2.75

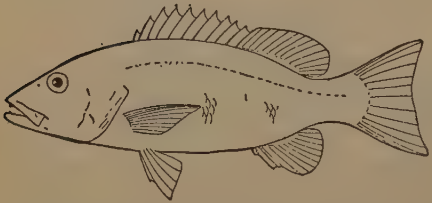
L. Caudal not deeply forked; gill-rakers 8 or 9 besides rudiments, vomerine patch of teeth with the median prolongation short or wanting, scales 8–60–15, soft dorsal and caudal red, other fins yellow, body rosy-green. *Spot Snapper*, 172.

LL. Caudal deeply forked; gill-rakers about 10 besides rudiments; vomerine teeth in an anchor-shaped patch; scales 9–53–15; body reddish with horizontal yellow streaks. *Cuban Snapper*, 173.

KK. Mouth large, maxillary 2.4; vomerine teeth in an anchor-shaped patch; scales 9–62–14, a large black lateral blotch, body color dark reddish brown, fins reddish. *Mahogany Snapper*, 173.

BB. Gill-rakers long and numerous, about 20 on the lower limb of the first arch; caudal lobes much produced in adult. *Yellowtail*, 173.

AA. Pterygoid teeth present, at least in adult; vomer with a diamond-shaped patch of teeth; dorsal spines about 12; gill-rakers long and slender, about 17 or 18 on lower limb of first arch; scales 60 to 68; color vermilion, paler below. *Vermilion Snapper*, 173.



Gray Snapper

Lutianus griseus
(Linnæus)

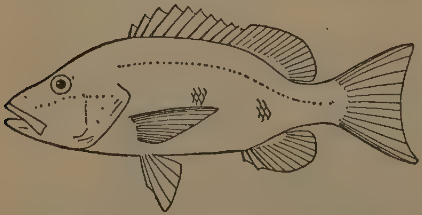
LaMonte, Pl. 25

West Indian, extending from Brazil to New Jersey, very common in the shallow water of the Florida Keys.

It frequently is found among mangrove roots and is considered one of the most palatable of snappers.

Feeds to a considerable extent on the small arboreal crabs of the mangrove trees.

Reaches a length of about 1½ feet and a weight of about 5 pounds, although as high as 18 have been recorded.



Dog Snapper

Lutianus jocu
(Bloch & Schneider)

A West Indian species, reaching from Brazil to Florida and straggling northward to Massachusetts.

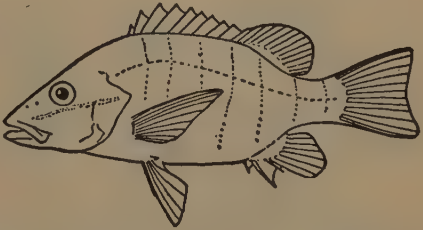
Although all other snappers are good food, this species is reputed to be unsuitable for human consumption.

Reaches a length of about 2 feet.

Schoolmaster

Lutianus apodus (Walbaum)

LaMonte, Pl. 24



Known from Brazil to Florida, straggling northward to Massachusetts when young.

Feeds largely on fishes and crustaceans.

Reaches a length of about 1½ feet. The average weight is 2 or 3 pounds, but as high as 8 pounds has been recorded.

Black-finned Snapper *Lutianus buccanella* (Cuvier & Valenciennes)

West Indies, rarely north to Key West, Florida.

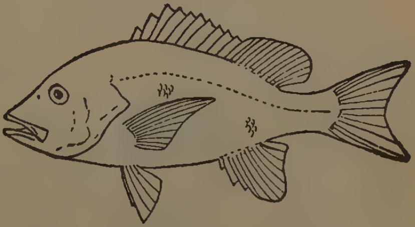
The name is derived from the fact that the bases of the pectorals are jet black.

Tends to keep to deeper waters.

Does not reach a very large size.

Pensacola Red Snapper

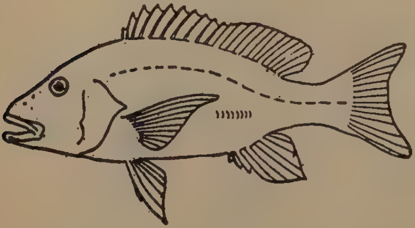
Lutianus blackfordi Goode & Bean



Gulf of Mexico east to Key West, Florida. Supposed to stray north to Massachusetts, but actually it may be the following species, for until recently the two have been confounded under one name.

Both species are inhabitants of rather deep water and of economic importance.

Reaches a length of about 2½ feet.

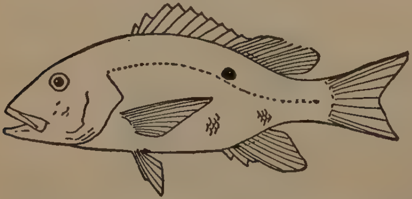


Caribbean Red Snapper

Lutianus campechanus (Poey)

West Indies north to Florida.

The exact range and other records of this are confused with the preceding, which see.



Muttonfish

Lutianus analis (Cuvier & Valenciennes)

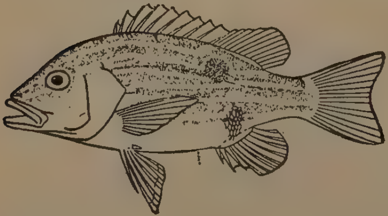
LaMonte, PL. 24

Known from Brazil to Florida, accidental as far north as Massachusetts.

A food fish of some importance.

Feeds on fishes and crustaceans.

Reaches a length of 27 inches and a weight of 25 pounds.



Spot Snapper

Lutianus synagris (Linnæus)

LaMonte, PL. 24

Known from Florida to Brazil.

A food fish of considerable importance where found.

Feeds on fishes and the larger invertebrates.

Rarely reaches a foot in length.

Cuban Snapper *Lutianus ambiguus* (Poey)

A rare fish known from Cuba and Key West, Florida.

It has been supposed to be a hybrid between the spot snapper and the yellowtail. This is purely hypothetical, however.

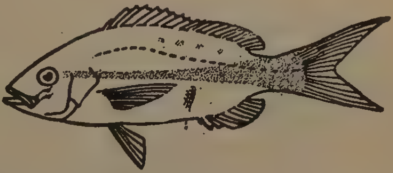
Reaches a length of about a foot.

Mahogany Snapper *Lutianus mahagoni* (Cuvier & Valenciennes)

West Indies north to the Florida Keys.

A handsome little snapper about which little is known.

Reaches a length of about a foot.



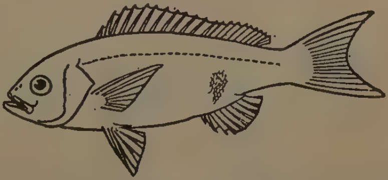
Yellowtail
Ocyurus chrysurus
(Bloch)
LaMonte, PL. 25

Known from southern Florida to Brazil.

A striking fish with usually a broad bright yellow streak from end to end. A food fish extremely popular with the Cubans.

Feeds on both vegetable and animal matter.

Reaches a length of about 2 feet.



Vermilion Snapper
Rhomboplites aurorubens
(Cuvier & Valenciennes)

Known from Charleston, South Carolina, to Rio de Janeiro in rather deep water, although sometimes enters shallow bays.

Apparently spawns in early spring.

A brilliantly colored fish, mostly of red and yellow.

Reaches a length of about 1 foot.

The Grunts—*Family Hæmulidæ*

A chiefly tropical family of rather small fishes which are usually valued as food. They are closely related to the snappers, from which they differ most prominently in the lack of vomerine and palatine teeth.

A. Preopercle strongly serrate, two of the spines at angle enlarged, the serræ on lower margin directed forwards. *Barred Grunt*, 176.

AA. Preopercle rather finely serrate, none of the serræ directed forward.

B. Soft parts of dorsal and anal densely scaled.

C. Dorsal spines normally 13; body elongate, the back little elevated.

D. Mouth large, the maxillary reaching middle of eye, its length about 2 in. head; gill rakers rather short and few; scales 50 to 55, second anal spine scarcely larger or longer than third, 2.75 or over in head.

E. Body oblong, the back moderately elevated, the depth 2.75 to 3. *Cæsar*, 176.

EE. Body subfusiform, the back little elevated, the depth 3.33 to 3.5. *Yellow Tom Tate*, 176.

DD. Mouth rather small, the maxillary not reaching to opposite middle of eye, its length not quite 2 in. head; gill rakers numerous, rather long; scales about 70; second anal spine notably longer and larger than third; body more elongate than in other species, depth about 3.5. *Common Tom Tate*, 176.

CC. Dorsal spines normally 12, occasionally 11 or 13, body elongate, the back scarcely elevated; mouth slightly oblique; sides with about 5 yellow horizontal stripes.

F. Snout short, more than 3 in. head; mouth small, the maxillary rather short, not curved. *Bronze Grunt*, 177.

FF. Snout long, usually 3 or less in head; mouth large, nearly or quite horizontal; maxillary long and curved.

G. Scales below lateral line notably enlarged, very deep; sides with yellow or brown stripes.

H. Sides with yellow stripes, parallel with lateral line above it and very oblique below. *Yellow Grunt*, 177.

HH. Sides with four brown stripes on a golden ground, ventral surface freckled with brown. *Golden Grunt*, 177.

I. Scales above lateral line enlarged, 4 rows between the lateral line and origin of dorsal; sides with about 12 well defined, more or less wavy, horizontal blue stripes. *White Grunt*, 177.

II. Scales above lateral line not enlarged, not fewer than 5 series between lateral line and origin of dorsal.

J. Maxillary reaching nearly or quite to middle of eye, 1.9 to 2.3 in head; sides with blue, black or golden stripes.

K. Gill rakers on lower limb of first arch 16 to 18, sides with black or blue stripes.

L. Soft dorsal with strongly convex margin, the anterior rays scarcely longer than the posterior ones; head and body with about 10 horizontal blue stripes. *Blue-striped Grunt*, 178.

LL. Soft dorsal with nearly straight margin, the anterior rays nearly twice as long as the posterior ones; upper part of sides with 4 or 5 dark stripes, no stripes on snout and cheeks. *Gray Grunt*, 178.

KK. Gill rakers fewer, 12 to 14 on lower limb of first arch; a dark band along base of dorsal and upper surface of caudal peduncle to base of caudal fin; another from snout through eye directly to base of caudal; sides with about 10 golden stripes. *Black-tailed Grunt*, 178.

JJ. Maxillary reaching to or slightly past anterior margin of eye, 2 to 2.8 in. head; sides with more or less distinct dark or pearly gray stripes following rows of scales. (Except the *black grunt* which has horizontal bronze stripes.)

M. Sides with horizontal bronze stripes; gill rakers on lower limb of first arch 13 or 14; 6 or 7 oblique rows of scales between lateral line and origin of dorsal. *Black Grunt*, 178.

MM. Sides with dark or pearly gray stripes following rows of scales.

O. Pectoral fins densely scaled; 5 oblique rows of scales between lateral line and origin of dorsal. *Sailors' Choice*, 178.

OO. Pectoral fins with a few scales at base, rest of fin naked, 7 oblique rows of scales between lateral line and end of dorsal. *Margate-fish*, 179.

BB. Soft part of dorsal and anal not densely scaled, naked or with small scales on the membranes only.

P. Body rather elongate; the head long; snout pointed; lips thin; second anal spine not notably enlarged. *Pigfish*, 179.

Q. Scales 6 or 7 rows between lateral line and first dorsal spine, color dark gray or brownish. *Black Margate*, 179.

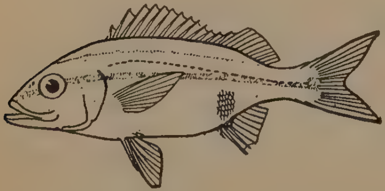
QQ. Scales in 10 or 11 rows between lateral line and first dorsal spine; alternate horizontal bluish and bronze stripes on sides; a dark band through nearly vertical eye and another over nape. *Porkfish*, 179.

Barred Grunt *Conodon nobilis* (Linnæus)

West Indian, north on our coast to Texas.

Sides typically with 8 dark cross bars.

Reaches a length of about 1 foot.



Cæsar

Bathystoma rimator (Jordan & Swain)

West Indies north to Cape Hatteras.

As with other members of this genus, it has the habit of moving about docks, et cetera, in shallow water, nosing into every little crack and cranny in search of food.

Omnivorous in habits.

Reaches a length of about 10 inches.

Yellow Tom Tate *Bathystoma aurolineatum* (Cuvier & Valenciennes)

West Indies north to the Florida Keys.

Not as common in our area as the other members of this genus.

Reaches a length of about 8 inches.

Common Tom Tate *Bathystoma striatum* (Linnæus)

West Indies north to the Florida Keys.

Due to the "inquisitive" habits of these fish, they amount to something of a nuisance to fishermen in constantly nibbling at bait intended for larger fish. However, though small, they are good to eat.

Reaches about 11 inches in length.

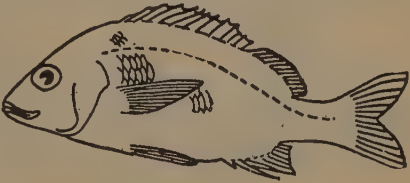
Bronze Grunt *Brachygenys chrysargyreus* (Günther)

West Indies north to the Florida Keys.

An exceedingly handsome little fish with bright bronze stripes. It is the smallest of the family in our range, at least.

Reaches a length of about 6 inches

Yellow Grunt
Hæmulon flavolineatum
(Desmarest)



West Indies north to the Florida Keys, but not especially common in our range.

As with so many species in this family, the mouth is brilliant red within. Combined with the yellow stripes on this species, the effect is striking when two individuals rush at each other open-mouthed.

Feeds largely on invertebrates.

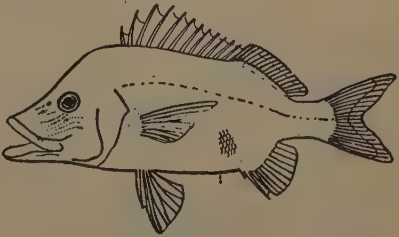
Reaches a length of 12 inches.

Golden Grunt *Hæmulon mowbrayi* Jordan & Evermann

Known only from Key West, Florida. Not common.

Probably does not reach over a foot in length.

White Grunt
Hæmulon plumieri
(Lacépède)
LaMonte, Pl. 26

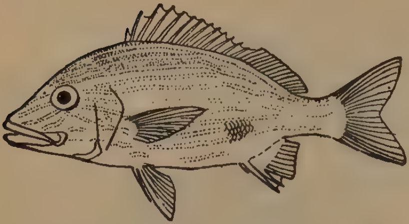


West Indies north to Cape Hatteras.

An abundant fish, much used for food in its range. It is usually the basis for the "grits and grunts" of the Key West natives.

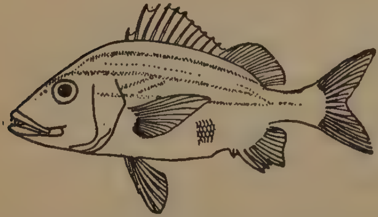
Omnivorous in habits.

Reaches a length of 18 inches, although usually under a foot



Blue-striped Grunt
Hæmulon sciurus (Shaw)
LaMonte, Pl. 26

West Indies north to Florida.
A rather handsome species.
Reaches a length of 18 inches.



Gray Grunt
Hæmulon macrostomum Günther

West Indies north to the Florida Keys.
A not very common species.
Reaches a length of about 14 inches.

Black-tailed Grunt *Hæmulon melanurum* (Linnæus)

West Indies north to the Florida Keys.
Reaches a length of about a foot.

Black Grunt *Hæmulon carbonarium* Poey

West Indies rarely north to the Florida Keys.
Reaches a length of 10 inches.

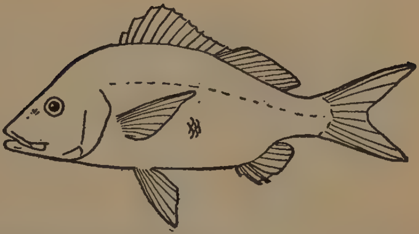
Sailors' Choice *Hæmulon parra* (Desmarest)

West Indies north to southern Florida.
A common species about the Florida Keys.
Reaches a length of about 12 inches.

Margate Fish

Hæmulon albium Cuvier & Valenciennes

LaMonte, Pl. 26



West Indies north to the Florida Keys.

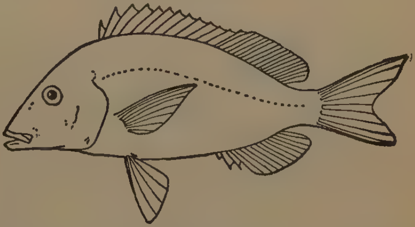
As it is a relatively large fish it is of considerable importance where found.

Reaches a length of over 2 feet.

Pigfish

Orthopristis chrysopterus (Linnæus)

LaMonte, Pl. 27



Occurs from New York to Texas, uncommon north of Virginia, but straggles north to Massachusetts.

Feeds largely on small crustaceans, mollusks, marine worms, etc.

A food fish of some importance.

Reaches a length of about 15 inches.

Black Margate *Anisotremus surinamensis* (Bloch)

LaMonte, Pl. 27

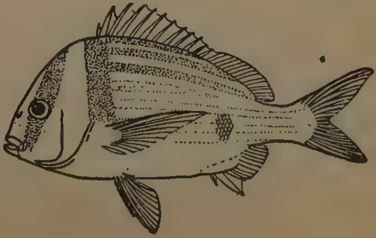
West Indies north to Florida.

This species reaches a larger size than any other of our grunts, and is consequently of economic importance where found.

Reaches about 3 feet in length.

Porkfish

Anistoremus virginicus (Linnæus)



West Indies to Florida.

A very common and handsomely marked food fish of Florida and southward.

Feeds largely on invertebrates.

Reaches a length of about a foot.

The Porgies—*Family Sparidæ*

Oblong or ovate fishes, usually well compressed, with the back rather elevated. The mouth is small but armed with strong jaw teeth. The young characteristically show dark cross bands which may or may not disappear with age.

A. Posterior nostril slit-like; second interhæmal bone enlarged, hollow anteriorly or pen shaped, receiving posterior end of air bladder.

B. Front teeth narrow, compressed, forming lanceolate incisors; the first spine bearing interneural with an antrorse spine.

C. Frontal bones partly porous and gibbous; antrorse dorsal spine attached directly to the interneural; third dorsal spine longer than head. *Long-spined Porgy*, 182.

CC. Frontal bones not porous of gibbous; antrorse dorsal spine attached to the interneural by a long process or spur; third dorsal spine about half head.

D. Body ovate, elliptical, the depth about the same from the first dorsal spine to the eleventh; anterior profile steep; pectoral shorter than head, 3.5 in body; snout short 2.5. *Northern Porgy*, 182.

DD. Body elongate, ovate, the depth decreasing backward from the first dorsal spine; anterior profile not very steep; pectoral about as long as head, 3.2. in body; snout long, 2 in head. *Southern Porgy*, 183.

BB. Front teeth conical or canine-like; the first spine bearing interneural without antrorse spine.

E. Scales comparatively small, 8 or 9—54 to 58 or 59; about 6 vertical rows of scales on base of preopercle, with about 12 scales entering into the formation of the lower margin.

F. Body very deep, the back elevated, the depth in adult half the length to base of caudal; outer teeth about $\frac{10-12}{12-16}$ in number, the outer one on each side, in one or both jaws, sometimes enlarged, canine-like and often directed forward.

G. Preorbital with reticulations of the bluish ground color around bronze spots; canines of upper jaw usually vertical but sometimes, especially in old examples, directed more or less forward; body deep, 1.9 to 2.25; depth of preorbital less than half head; pectorals a little more than ⅓ body, color silvery, the center of most scales golden, the edge bluish, forming streaks, a deep violet streak below eye. *Saucer-eye Porgy*, 183.

GG. Preorbital region, snout, cheek and opercles brassy, crossed by wavy non-reticulating lines of violet blue, brightest on preorbital and snout; a sky-blue blotch behind eye over opercle extending on body; outer canines of upper jaw directed forward except in very young; color silvery, each scale with a violet spot above and an orange spot below, sides usually with dark cross bars. *Little-head Porgy*, 183.

FF. Body more elongate, depth 2.4, upper jaw without antrorse canines, color dull brassy with little blue, a faint blue stripe below eye; preorbital dull coppery; usually plain but sometimes faintly veined with blue. *Jolt-head Porgy*, 183.

EE. Scales comparatively large, 6 or 7—45 to 52—13 or 14; about 5 vertical rows of scales on base of preopercle with about 9 scales entering into the formation of the lower margin; no antrorse canines.

H. Pectorals long, about 3 in body; scales 50 to 52; no black axillary spot; blotches on fins; color dirty silvery with dark cross bars. *White-bone Porgy*, 184.

HH. Pectorals shorts, about 3.5 in body.

I. Dorsal outline forming a comparatively regular arch; depth about 2.17; color dull silvery with pearly spots on scales of back; axil with a small inky spot; cross bars on body usually present. *Little-mouth Porgy*, 184.

II. Dorsal outline not forming a regular arch; depth about 2.5; color olivaceous with dark bars and spots; many scales with pearly centers; 6 yellowish spots along lateral line; fins mostly barred or spotted. *Grass Porgy*, 184.

AA. Second interhæmal spine normal, not pen shaped.

J. Front teeth conic, not compressed; no incisors; no antrorse spine on first interhæmal, dorsal spines 11 or 12. *Red Porgy*, 184.

JJ. Front teeth incisor-like; no canines; molars in 2 to 4 series in each jaw.

K. First spine-bearing interneural with an antrorse spine in front.

L. Incisors conspicuously notched; dorsal XII, 11; scales 65 to 70. *Pinfish*, 184.

LL. Incisors entire or with a shallow notch.

M. Streaked with steel blue and gold; a dark humeral spot; dorsal XIII, 10; scales 45 to 50. *Brim*, 185.

MM. Seven vertical black bands; no humeral spot; dorsas XII, 10 or 12; scales 48. *Sheepshead*, 185.

KK. First spine bearing interneural without antrorse spine in front.

N. Scales about 56; eye 4.5. *Holbrook's Porgy*, 186.

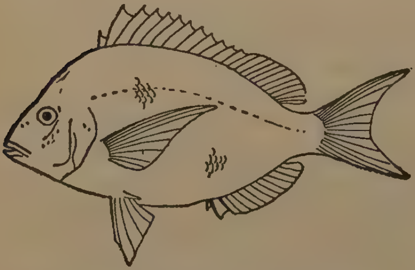
NN. Scales 62 to 65; eye 3.5. *Silvery Porgy*, 186.

Long-spined Porgy *Otrynter caprinus* (Bean)

Deep waters off the coast of Florida and Carolina, usually from snapper banks.

Not common in our shallow water range.

Reaches about a foot in length.



Northern Porgy

Stenotomus chrysops (Linnæus)

LaMonte, Pl. 28

Known from South Carolina, casually to Maine.

Spawns in late spring (June in New York and Massachusetts.) The eggs are spherical, buoyant, transparent and average about 0.87 mm. in diameter. They hatch in about 40 hours at a temperature of 72° F. On hatching, the young measure about 2.8 mm. They probably spawn for the first time in the third summer.

Porgies feed chiefly on crustaceans, worms, mollusks, fish, squid and some vegetable matter.

This is the porgy of commerce.

Reaches a length of about 16 inches and a weight of 2 pounds, although there are reports as high as 4 pounds.

Southern Porgy *Stenotomus aculeatus* (Cuvier & Valenciennes)

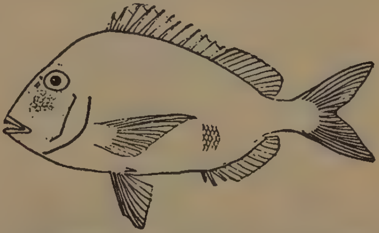
Known from Cape Hatteras to Texas.

This species closely resembles the northern porgy which it replaces largely to the south.

Reaches a length of about a foot.

Saucer-eye Porgy

Calamus calamus
(Cuvier &
Valenciennes)



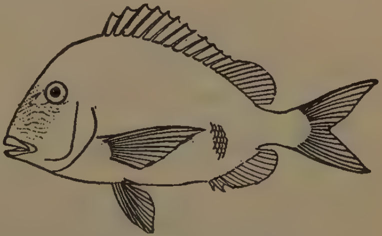
West Indies north to the Florida Keys, where it is common, but less so than the two following species.

Omnivorous in habits.

Reaches a length of 15 inches.

Little-head Porgy

Calamus proridens
Jordan & Gilbert
LaMonte, PL. 29



West Indies north to the Florida Keys. Abundant.

This is the most brightly colored porgy in our range.

Feeds largely on crustaceans.

Reaches about a foot in length.

LaMonte, PL. 28

Jolt-head Porgy *Calamus bajanado* (Bloch & Schneider)

West Indies north to the Florida Keys. By far the most abundant species of the genus in the southern part of our range.

It has been thought that the common name has been derived from its habit of "jolting" mollusks loose from rocks and piling with its hard jaws. Omnivorous in habits.

A relatively dull colored species.

Reaches a length of 2 feet and a weight of 8 pounds.

White-bone Porgy *Calamus leucosteus* Jordan & Gilbert

Deep water off the southern states. Known principally from South Carolina. Probably rare normally in our range.

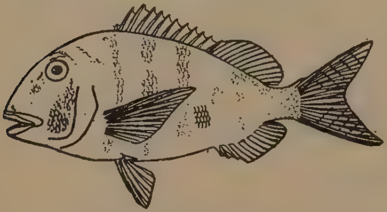
Reaches a length of about a foot.

Little-mouth Porgy *Calamus penna* (Cuvier & Valenciennes)

West Indies north to Florida.

Not uncommon, but less abundant than other Florida shore porgies.

Reaches a length of about a foot.



Grass Porgy
Calamus arctifrons
Goode & Bean.

Gulf of Mexico. Common on the west coast of Florida.

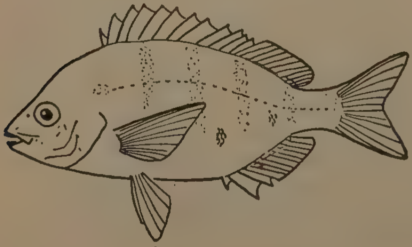
This is one of the most handsome porgies, being variously mottled and capable of considerable color change. Its pattern makes it rather difficult to find amid the eel grass that it normally lives in.

Reaches about a foot in length.

Red Porgy *Pagrus pagrus* (Linnæus)

A species of southern Europe occasionally taken on our southern coast, at Charleston, South Carolina, and off Pensacola, Florida.

Reaches a length of 2 feet.



Pinfish
Lagodon rhomboides
(Linnæus)

LaMonte, Pl. 29

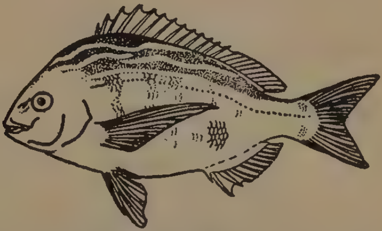
Known from the Gulf and Atlantic coasts from Cape Cod to Cuba, but not abundant north of Delaware.

A food fish of some importance in the south.

Reaches a length of about 10 inches.

Brim

Archosargus unimaculatus
(Bloch)



West Indies, north to the Florida Keys, where it is not rare.

Feeds on invertebrates and vegetable matter.

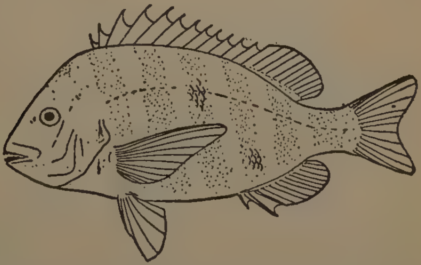
Spawns in spring. The eggs average about 0.40 mm. in diameter.

Reaches a length of about a foot.

Sheepshead

Archosargus probatocephalus
(Walbaum)

LaMonte, Pl. 30



Occurs from Cape Cod to Texas, casual to the Bay of Fundy. Formerly common in the latitude of New York but now unknown there.

In Florida this species spawns in March. The eggs are spherical, non-adhesive, buoyant and measure about 0.8 mm. in diameter. They hatch in about 40 hours at a temperature of 77° F.

Reaches a length of about 30 inches and a weight of 20 pounds.

Holbrook's Porgy *Diplodus holbrookii* (Bean)

Gulf of Mexico and north to Cape Hatteras. Common in places.

A broad black saddle on the peduncle separates this and the following species from the other porgies.

Reaches a length of about 10 inches.

Silvery Porgy *Diplodus argenteus* (Cuvier & Valenciennes)

West Indies, north to Florida.

Not nearly as common as the preceding species.

The Mojarras—*Family Gerridæ*

Rather deep bodied silvery fishes with excessively protactile mouths. The premaxillary process slips into a long groove under the skin on top of the forepart of the head, hiding the mechanism that allows of throwing the mouth so far forward.

A. Preopercle entire; anal spines 3; the second little enlarged; second interhæmal spine hollow, cone shaped; its cavity entered by the posterior end of the air bladder.

B. Premaxillary groove crossed or nearly so by scales in front, leaving a naked pit behind; body depth 2.2 to 3. *Common Mojarra*, 187.

BB. Premaxillary groove not crossed by scales in front, open and linear; body depth 2.5 to 3.3. *Gill's Mojarra*, 187.

AA. Preorbital serrate or entire; anal spines 2 or 3, the second enlarged or not; second interhæmal spine not hollow or entered by air bladder.

C. Anal spines 2, the second small; preopercle entire. *Florida Mojarra*, 187.

CC. Anal spines 2 or 3, the second large.

D. Preopercle entire; anal spines 3; the second moderate.

E. Body deep, the depth 2.25 to 2.6; premaxillary groove broad; sides of body with dark cross-bars. *Gray Mojarra*, 188.

EE. Body slender, the depth 3; premaxillary groove narrow, restricted anteriorly; sides without cross-bars. *Cuban Mojarra*, 188.

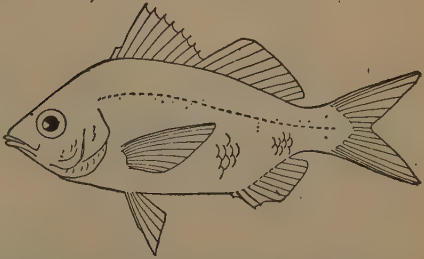
DD. Preopercle serrate; the second anal spine much enlarged.

F Preobital entire; anal spines 2; no dark lines on scale rows. *Irish Pompano*, 188.

FF. Preorbital serrate; anal spines 3; dark lines on scale rows. *Patao*, 188.

Common Mojarra

Eucinostomus gula
(Cuvier & Valenciennes)



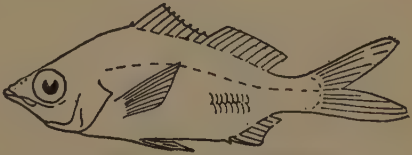
A West Indian species ranging from Brazil to North Carolina and straggling north to Massachusetts.

It is not certain that this alleged species is distinct from the following.

Rheecas a length of 5 inches.

Gill's Mojarra

Eucinostomus californiensis
(Gill)



A West Indian and Pacific coast species reaching northward on our coast to Chesapeake Bay.

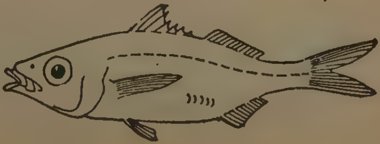
It is of no especial commercial importance on account of its small size, although very abundant on the coasts of the southern states.

Feeds on both animal and vegetable matter.

Reaches a length of about 8 inches.

Florida Mojarra

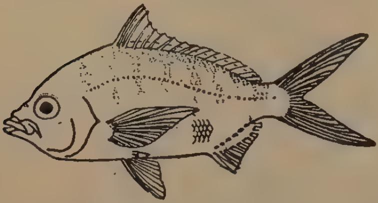
Ulæma lefroyi
(Goode)



Known from Florida to Brazil.

A species easily distinguished from the preceding on the basis of its internal construction as mentioned in the key.

Reaches a length of about 8 inches.



Gray Mojarra
Gerres cinereus
(Walbaum)

West Indies and the Pacific, north on our coast to Florida.

Spawns in spring. Omnivorous in habits.

Reaches a length of about 15 inches.

Cuban Mojarra *Gerres havana* (Nichols)

Known from Cuba and Florida. Not common.

Reaches a length of at least a foot.

Irish Pompano *Diapterus olisthostomus* (Goode & Bean)

West Indies north to Florida.

Generally common.

Reaches a length of about 12 inches.

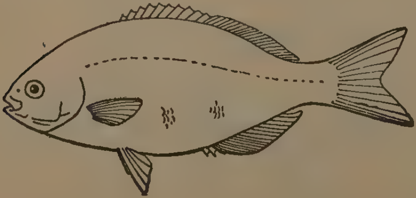
Patao *Diapterus plumieri* (Cuvier & Valenciennes)

West Indies north to Florida.

Reaches a length of about 10 inches.

The Chubs—*Family Kyphosidæ*

Tropical fish with rather chunky bodies, jaws armed with small but strong teeth. Usually of rather dull coloration. A single species in our range.



Bermuda Chub
Kyphosus sectatrix
(Linnæus)

Occurs from Cape Cod to the West Indies and the Canary Islands. Common about the Florida Keys and Bermuda.

Omnivorous in food habits, feeding on both animal and vegetable matter and various kinds of offal.

Reaches about 18 inches in length.

The Croakers—*Family Sciænidæ*

Fishes of considerable economic importance, represented on our coast by a variety of very different looking species. They range from small reef fishes to species of wide ranging habits of large size. In this family are many species sought after by the sea angler and the surf caster. The majority convey the impression of a "typical fish." They are a specialized offshoot of the central spiny rayed group. They may be recognized by the lateral line which extends out onto the tail fin to its edge and the possession of not more than two spines in the anal fin, whereas fishes which might be confused with them have three or more and do not have the lateral line extending out onto the fin proper. The spinose and rayed dorsals are not ever separated by any great distance and are often connected as one fin. Internally they are characterized by peculiar specializations of the air bladder. In most species it is so modified as to be capable of being operated as a resonating chamber for the production of sound. It is from this fact that the name "Croaker" is derived. A few species lack the swim bladder entirely and sink to the bottom when not actively swimming. Such species are of course voiceless. The central members of the family should be thought of as primarily fishes of the sandy shores of tropical seas, although various members have traveled far in habit and form. Some are almost entirely pelagic and some are reef inhabiting, or even in fresh water exclusively.

A. Dorsal spines well separated; dorsal rays 20 to 32.

B. No mandibular barbels.

C. Mouth large, lower jaw excluded, 2 canine teeth at tip of upper jaw, none at tip of lower jaw, back not elevated, body fusiform, little compressed.

D. Soft rays of dorsal and anal fins more or less closely scaled, gill rakers long and slender, 9 to 12 on lower limb of first arch.

E. Coloration nearly uniform silvery; anal fin with 9 soft rays; 9 gill rakers on lower limb of first arch; 8 scales between anal origin and lateral line. *Silver Squeteague*, 191.

EE. Body marked with numerous irregular blotches, some of which form wavy oblique lines running forward and downward; anal with 11 or 12 soft rays; 11 to 13 gill rakers on lower limb of first arch; 10 scales between anal origin and lateral line. *Weakfish*, 191.

DD. Soft rays of dorsal and anal fins scaleless, gill rakers comparatively short and thick, 6 to 8 on lower limb of first arch, body covered with round black spots. *Spotted Squeteague*, 192.

CC. Body somewhat compressed, back elevated, no canines in jaw.

F. Teeth well developed, present in both jaws.

G. No black spot at base of caudal fin.

H. Lower jaw projecting; interorbital space not cavernous, head not broad above.

I. Snout less than diameter of eye; mouth large, very oblique, no bony teeth on margin of preopercule.

J. Dorsal rays 24 to 26, anal rays 5 to 6. *Banded Croaker*, 192.

JJ. Dorsal rays 28, anal rays 8. *Corvula*, 192.

II. Snout equal to or greater than eye, mouth moderate, slightly oblique, margin of preopercule serrate. *Silver Perch*, 193.

HH. Lower jaw equal to or shorter than upper, interorbital space cavernous, the septa very thin, head broad above. *Star Drum*, 193.

GG. One or more black ocellated spots at base of caudal fin. *Channel Bass*, 194.

FF. Teeth very small, those in lower jaw deciduous or wanting, mouth inferior and small. *Spot*, 194.

BB Mandibular barbels present.

K. A row of minute barbels on each side of lower jaw. *Croaker*, 195.

KK. A single thick barbel at tip of lower jaw.

L. Ventrals one-half longer than pectorals, 2 anal spines. *Umbrina*, 195.

LL. Ventrals shorter than pectorals, 1 anal spine.

M. Lining of gill cavity dusky, body marked with an irregular pattern of bars and blotches.

N. Third dorsal spine reaching much past origin of soft dorsal, coloration usually dark. *Northern Kingfish*, 195.

NN. Longest dorsal spine not reaching soft dorsal, coloration usually light. *Southern Kingfish*, 196.

MM. Lining of gill cavity pale, body not blotched or barred, longest dorsal spine just reaching soft dorsal. *Gulf Kingfish*, 196.

KKK. Numerous large barbels along inner edge of each side of lower jaw, the series usually reaching back to below middle of eye. *Sea Drum*, 196.

AA. Dorsal spines close together; dorsal rays 36 to 53; body tapers rapidly backwards.

O. Dusky gray with at least traces of about seven lengthwise streaks. *Cubbyu*, 197.

OO. Not with seven lengthwise streaks.

P. Three brown longitudinal bands along sides, the central one reaching from eye backward to tips of middle caudal rays. *Striped Ribbonfish*, 197.

PP. Three edged bands, one vertical through eye, one diagonally from nape to ventrals, third curving from dorsal to caudal. *Ribbonfish*, 197.

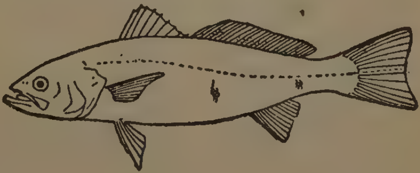
Silver Squeteague *Cynoscion nothus* (Holbrook)

A food fish of the Gulf coast. Rarely taken on the Atlantic coast of Florida, where it is largely replaced by the spotted squeteague, although known north to Maryland. In habits it keeps more to open waters than its two congeners. Although less common where found than these other two, it is abundant in winter off the coast of Alabama, Louisiana, and Texas in depths of from three to ten fathoms. Very little is known of its habits, but young specimens suggest that it spawns in fall. While we have no definite records of size it is not known to reach as large a size as the other two species of this genus.

Weakfish

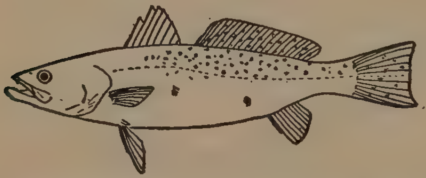
Cynoscion regalis (Bloch & Schneider)

LaMonte, Pl. 31



An important commercial and anglers' fish of the north and middle Atlantic states. It is the most economically important species of the entire Croaker family of the United States. The spawning season is protracted, reaching from May to

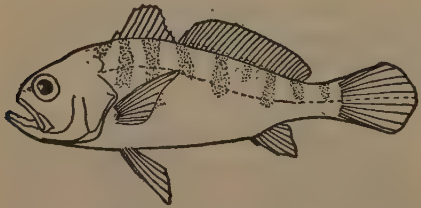
September and extending from the Carolinas to Cape Cod. The eggs are liberated free in the water at depths of from three to five fathoms from where they float up and drift about at the surface for the short time it takes them to hatch, which is about a day and a half at the usual temperatures. The first spawning takes place when the fish are from three to four years old and annually thereafter. It occurs from Massachusetts to Florida and straggles into the Gulf as far as Mobile. Thirty pounds have been recorded for this species but a weight of over 5 or 6 pounds is exceptional, although 10 pounds cannot be exactly considered rare.



Spotted Squeteague

Cynoscion nebulosus (Cuvier & Valenciennes)

The sea trout of southern waters. Occurs from New York to Texas although it is scarce on the Gulf coasts and uncommon north of Delaware. Its life history is not so well known as its more northward-ranging relative, the weakfish. It does not reach such a large size, apparently not exceeding 7 pounds.



Banded Croaker

Larimus fasciatus Holbrook

Ranges from Chesapeake Bay to Texas, and rarely straggles northward. Little is known of its development and it tends to keep offshore. It attains a length of 10 inches but over 8 is rare. Not of commercial significance.

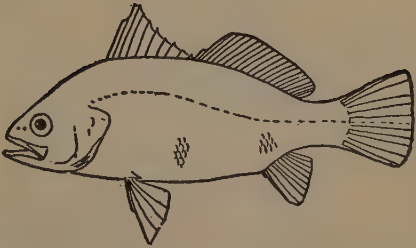
Corvula *Corvula sialis* (Jordan & Eigenmann)

A rare and little known form from the Florida Keys.

Silver Perch

Bairdella chrysura
(Lacépède)

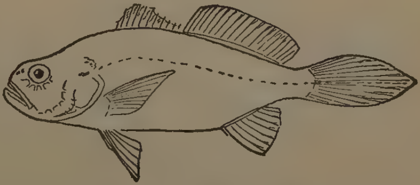
LaMonte, PL. 31



A fair pan fish often confused with the white perch (*Morone americana*), but from which it is readily distinguished by two of the family characters, two anal spines instead of three and the lateral line reaching out onto the tail fin. Generally taken on sandy shores from New York to Texas. The eggs of this species, like all the others known of this family, are pelagic and hatch rapidly, in this case in a little less than two days normally. They mature in a year and from then grow much slower. They may reach a length of about a foot although are usually much less. They are typical shore fishes and their northward extension should not be considered as a Gulf Stream drift but more as the normal extent of their range. They appear to migrate offshore in the colder months. At least in the northern part of their range they are only present in the bays in summer. Their absence at Woods Hole where most of our Gulf Stream derelicts from Massachusetts are recorded substantiates the permanence of their northern range.

Star Drum

Stellifer lanceolatus
(Holbrook)



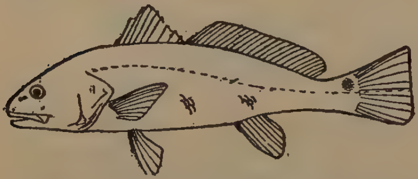
Known from South Carolina to Texas, tending to keep in rather deep water.

It is not a common species at any one place but is taken in fair numbers by the shrimp trawlers off Fernandino, Florida.

As it is small and bony it is one of our few Croakers not of commercial importance.

Spawning occurs in late spring and early summer. It feeds principally on small plankton organisms.

Rarely exceeds 6½ inches in length.



Channel Bass

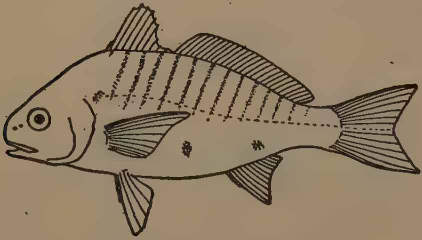
Sciænops ocellatus
(Linnæus)

LaMonte, Pl. 32

Occurs on sandy shores from New York to Texas. Now rare north of Virginia and only occasionally reaches north of New Jersey.

So far as known most of the breeding of this species occurs south of the Chesapeake Capes. The spawning season is in the late fall and winter. The eggs and larvæ are unknown.

Reaches a length of about 5 feet and a weight of 75 pounds.



Spot

Leiostomus xanthurus
Lacépède

Occurs from Cape Cod to Texas.

The spot is very variable in numbers from year to year, sometimes being so abundant as to cause inconvenience to pumping plants. The most recent appearance in great numbers in the latitude of New York was in 1925 when the Brooklyn Edison Company and other concerns experienced difficulty with literally tons of these fish becoming clogged in their condenser pumps. Previous great runs in New York harbor occurred in 1917, 1908 and 1902.

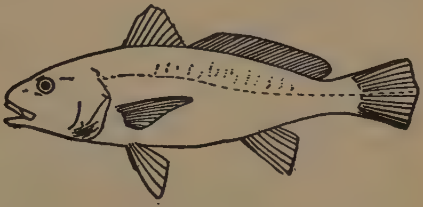
Spawning occurs in late fall and early winter. The eggs and larvæ are unknown.

A good pan fish.

Reaches a length of 12 inches and a weight of ¾ pound.

Croaker

Micropogon undulatus (Linnæus)



Ranges from New York to Texas on sandy shores.

The spawning season is long, extending from August to September and possibly earlier southward. The eggs and larvæ are unknown. Maturity is reached in the third or fourth year.

Reaches a length of a little more than a foot.

Umbrina *Umbrina coroides* Cuvier & Valenciennes

Known from Florida to Brazil.

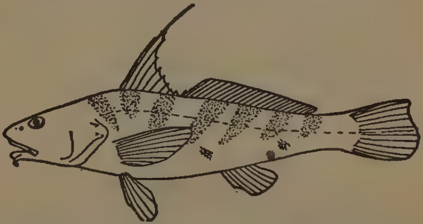
Little is known of it.

Reaches a length of 8 inches.

Northern Kingfish

Menticirrhus saxatilis (Bloch & Schneider)

LaMonte, Pl. 33



Occurs from Cape Ann to Florida, but common only north of the Chesapeake Bay. Rarely straggles to Casco Bay, Maine.

Common on sandy shores where it swims close to the bottom in search of food such as crabs, squid, amphipods, isopods, shrimps, worms, young fish and bryozoa.

Spawns in June and July. The eggs are buoyant, faintly yellowish, transparent, and average 0.78 mm. in diameter. They hatch in about 48 hours at a temperature of 69° F. Post larval kingfish closely resemble the adult at a much smaller size than do most members of this family. Maturity is reached in the second or third year.

This species and its congeners are remarkable in this family in not possessing an air bladder.

Reaches a length of about 17 inches and a weight of 2 or 3 pounds.

Southern Kingfish *Menticirrhus americanus* (Linnæus)

Known from New Jersey to Texas. Not common north of Chesapeake Bay or in the Gulf of Mexico.

This species closely resembles the northern kingfish which it largely replaces to the southward.

Believed to spawn in the latter part of summer. By the time the young are 40 mm. long they strongly resemble the adults. Maturity is reached in 3 years.

A food fish of considerable importance in the south.

This species feeds largely on invertebrates and small fishes.

Reaches a length of about 15 inches.

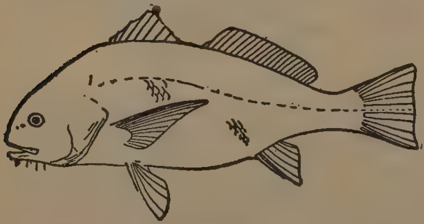
Gulf Kingfish *Menticirrhus littoralis* (Holbrook)

Known from Chesapeake Bay to Texas, replacing the southern kingfish largely in the Gulf of Mexico.

A food fish of some importance often confounded with the southern kingfish.

Feeds largely on crustacea.

Reaches about 18 inches in length.



Sea Drum
Pogonias cromis
(Linnæus)

LaMonte, Pl. 33

Occurs on the Atlantic and Gulf coasts from New York (casually to Massachusetts) to the Rio Grande. Also recorded from South America as far as Argentina.

Although most of the members of this family are capable of making some sort of noise, the sea drum, because of its large size and elaborate sound producing apparatus, is probably the best known.

Little is known of the sea drum's life history. The young (under a foot) are conspicuously marked with vertical bands not unlike a sheepshead.

The adults are usually dark gray but on the New Jersey coast certain large examples are frequently quite coppery red and seem to be lightly slimmer than the dark ones. Just what this means is not known.

They feed chiefly on shellfish and a large marauding school can do considerable damage to an oyster bed.

Reaches over 4 feet in length and a weight of 146 pounds.

Cubbyu *Eques acuminatus* (Bloch & Schneider)

Known from North Carolina to Brazil.

This species and the following two members of the family are specialized forms living in and about coral reefs for the most part. Little is known of their habits.

Seldom reaches a foot in length.

Striped Ribbonfish *Eques pulcher* (Steindachner)

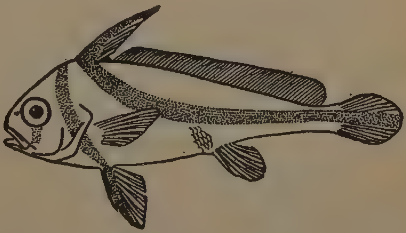
A West Indian species, reaching north to the Florida Keys.

Tends to keep more in the open over sandy bottoms, between coral snags, than does the following species.

Usually less than 8 inches long.

Ribbonfish

Eques lanceolatus (Linnæus)



A West Indian species reaching northward to Pensacola, Florida.

Tends to keep closer to the reefs than does the former.

Feeds largely on crustaceans.

Does not normally exceed 10 inches in length.

The Demoiselles—*Suborder Chromides*

A group at once marked by the possession of a single nostril on either side.

The Demoiselles—*Family Pomacentridæ*

Short, deep-bodied fishes of tropical reefs. They are covered with ctenoid scales; the lateral line is absent posteriorly; there is a single nostril on each side; the mouth is small and the jaws provided with either conic or incisor-like teeth.

Most of the species live in and about coral reefs and are rather similar in habits to the angelfishes but generally smaller. They are usually brightly colored.

A. Teeth fixed, conical or incisor-like, covering nearly the entire free edge of each jaw.

B. Teeth conical, in 2 to 4 series, the outer enlarged and bluntish; preopercle entire; tail deeply forked often with produced lobes; depth not more than ⅔ length.

C. Caudal deeply forked, its lobes acute; soft dorsal and anal not reaching caudal; dorsal spines 12; snout rather acute; caudal fin with a black border on each lobe. *Reef Fish*, 199.

CC. Caudal moderately forked, its lobes mostly rounded; soft dorsal and anal reaching past base of caudal; dorsal spines 13; snout rather obtuse; candal fin plain, not edged with black. *Chauffe-Soleil*, 199.

D. Caudal and other fins plain dusky.

DD. Caudal, posterior half of dorsal and anal, and all of pectorals deep yellow; a blue line on side of head. *Yellow-tailed Reef Fish*, 199.

BB. Teeth more or less flattened or incisor-like, in 1 or 2 series.

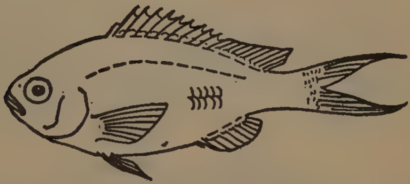
E. Preopercle, and usually preorbital also, sharply serrate; teeth entire, strictly uniserial in each jaw; preorbital not very deep, its edge not notched; snout scaly; lower jaw naked; color variable, predominately blue and yellow. *Beau-gregory*, 199.

EE. Preopercle and preorbital entire; teeth emarginate or Y-shaped; preorbital moderate, its edge not notched; snout naked; barred vertically with black and yellow. *Sergeant-major*, 200.

AA. Teeth moveable, incisor-like, in a single row in each jaw; the lower jaw weak, the teeth along its front only; preopercle and preorbital entire; snout scaled almost to lips; prorbital notched behind nostril; lower limb of preopercle scaled; tail usually abruptly bright yellow. *Yellow-tailed Demoisell*, 201.

Reef-Fish

Chromis marginatus
(Castelnau)



A variable West Indian form that has been divided into a number of nominal species on the basis of color alone. These have since been reduced to races and it is not certain just which form reaches Florida. About the Keys they are not uncommon near wharves.

Does not reach over 6 inches in length

Chauffe-Soleil *Chromis insolatus* (Cuvier & Valenciennes)

A West Indian form reaching rarely north to Pensacola. Tends to keep in deep waters.

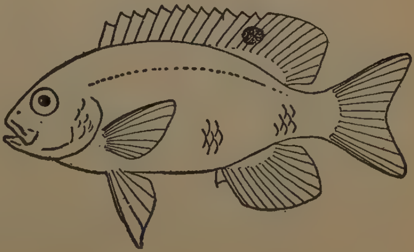
Reaches about 4 inches in length.

Yellow-tailed Reef Fish *Chromis enchrysurus* (Jordan & Gilbert)

Known chiefly from the stomachs of snappers and groupers taken off Pensacola and Tampa. Differs from the preceding only in color and may be merely a phase and not a distinct species.

Beau-gregory

Pomacentrus leucostictus
(Müller & Troschel)



Occurs in the West Indies north to Florida and straggling north rarely to Katama Bay, Maine.

An abundant reef and dock form of great variation. There have been many species recognized but their exact status has never been satisfactorily established. Until this has been done little can be said that is within our province here although it presents a fascinating problem. Those real or nominal species recorded from within our range have been separated according to the following key although various intermediates make them exceedingly questionable. It is quite possible that but one form is represented in our region.

A. Lower posterior half of body dark, like anterior half; caudal fin mostly dusky.

B. Anal without distinct blue spot in its posterior axil, except in young; base of pectoral with one black spot. *P. fuscus.*

BB. Anal with a bluish spot at base of last ray; head and fins much spotted with blue. *P. ovalis.*

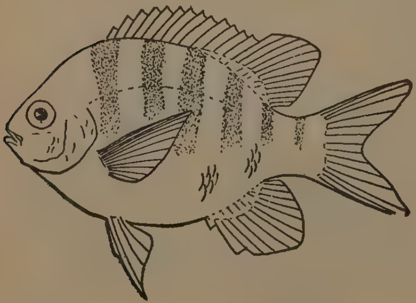
AA. Lower posterior half of body unlike anterior part, being more or less abruptly bright yellow; caudal fin bright yellow; usually a blue spot at base of last anal ray.

C. Region below lateral line with many blue spots. *P. leucostictus.*

CC. Region below lateral line with few blue spots or none. *P. flaviventer.*

All except the last of the above are recorded from Florida. The last from Mexico, presumably near our limit.

Reaches a length of about 6 inches.



Sergeant-major

Abudefduf saxatilis
(Linnæus)

Occurs on both coasts of tropical America from Uruguay to Florida, straggling very rarely to Rhode Island.

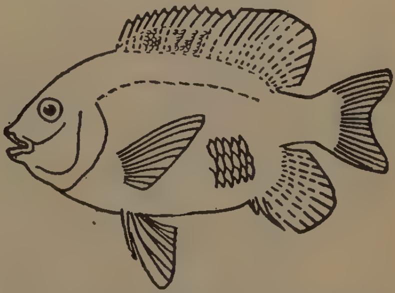
As this species spawns in the early fall in Florida, the young if drifted northward would soon encounter water too cold for them to survive. This would seem to account for their rare occurrence northward as compared with the spring spawners of the tropics.

An exceedingly abundant form about coral reefs and prominent because of its conspicuous yellow and black vertical bands.

Reaches a length of 6 inches.

Yellow-tailed Demoiselle

Microspathodon chrysyrus
(Cuvier & Valenciennes)



A West Indian form ranging north to southern Florida.

The adults are dark bodied with a brilliantly yellow tail. The young lack the yellow tail and are covered with light blue spots about the size of a scale. They were formerly thought to represent a distinct species.

Feeds on organic debris.

Reaches a length of about 6 inches.

THE LABROID FISHES—*Suborder Pharyngognathi*

Chiefly tropical fishes of bright colors with cycloid scales and hard teeth often fused into a beak.

A. Teeth in jaws conical or tubercular, usually somewhat directed forward. *The Wrasses*, 202.

AA. Teeth in jaws fused into a parrot-like beak, usually so solid that the individual teeth cannot be distinguished. *The Parrot Fishes*, 208.

The Wrasses—*Family Labridæ*

Chiefly tropical fishes, oblong or elongate and covered with large cycloid scales. The lateral line is continuous, or interrupted and often angulated. The jaws are usually provided with strong canine-like teeth. The dorsal fin is continuous and usually the spinous portion is long. These fishes are provided with powerful pharyngeal teeth with which they crush mollusks. Dwelling mostly among corals and in rocky places, they are frequently brilliantly colored.

A. Dorsal spines 14 to 21; anal spines 3; lateral line complete (northern species).

B. Preopercle serrate; opercles scaly; scales about 46; snout somewhat produced. *Cunner*, 204.

BB. Preopercle entire; opercles naked; scales about 60; snout blunt. *Tautog*, 204.

AA. Dorsal spines 8 to 14; anal spines 2 or 3; lateral line various (tropical species).

C. Dorsal spines usually 12 (11 to 14); sides of head more or less scaly; preopercle serrulate or entire.

D. Anterior canines strong; spinous dorsal not enveloped in scales; lower jaw naked; mostly of large size and bright coloration.

E. Dorsal spines about 14, the 3 or 4 anterior falcate, produced in long streamers; body deep and compressed, the anterior profile steep; teeth uniserial; no posterior canines; cheeks and opercles scaly; soft parts of vertical fins produced; scales about 40; color generally red or brownish. *Hogfish*, 205.

EE. Dorsal spines 11 or 12 (rarely 13), none produced as filaments; cheeks and opercles scaly; body oblong; the back not greatly elevated.

F. Soft dorsal and anal each with a scaly sheath at base; scales about 32; posterior canine present; soft dorsal and anal elevated, produced behind; posterior half of body yellow. *Spanish Hogfish*, 205.

FF. Soft dorsal and anal without sheath of scales; preopercle serrulate; soft dorsal and anal more or less falcate; scales about 30; posterior canine present; posterior half of body not abruptly yellow. *Cuban Hogfish*, 205.

DD. Anterior teeth small and bluntish, not canine-like; no posterior canines; mouth very small, terminal; snout short and blunt; dorsal and anal enveloped in scales, except produced tips of both fins; caudal deeply forked; dorsal spines almost hidden by series of scales; head everywhere closely scaled, except on lips and snout; pectoral falcate; dorsal spines 12. *Creole*, 206.

CC. Dorsal spines 8 or 9; head mostly naked; preopercle entire.

G. Lateral line complete and continuous.

H. Dorsal spines 9, without scaly sheath; scales of breast not enlarged; posterior canines well developed; caudal not edged with black.

I. Brownish above, no row of blue spots on each side; an orange olive area behind head followed by blue cross band at vent; belly tinged with orange; irregular spots of blue or green on head. *Pudding-wife*, 206.

II. Olivaceous above, a row of blue spots on each side, an orange band on side extending back to middle of side, its lower edge serrate, belly pearly; three blue stripes on cheeks. *Painted Doncella*, 206.

HH. Dorsal spines 8; no posterior canines; a low sheath of scales at base of dorsal; caudal edged with black. *Blue-head*, 206.

GG. Lateral line interrupted posteriorly, beginning again on the level of the axis of the body, on caudal peduncle; scales about 25; dorsal spines 9.

J. Anterior profile concave; posterior canine present; body not especially compressed; cheeks and opercles scaly; the 3 first dorsal spines with filamentous appendages; dorsal and anal with scaly sheath; scales about 20. *Dwarf Wrasse*, 207.

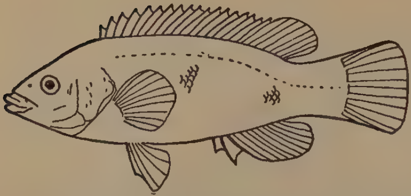
JJ. Anterior profile more or less convex; no posterior canine; head naked, except for a few scales below eye; body strongly compressed.

K. Scales very large, about 20; lateral line on first row of scales below dorsal. *Dwarf Razor-fish*, 207.

KK. Scales large, about 26; lateral line on second row of scales below dorsal.

L. Upper anterior profile of head not trenchant, the curve of head not parabolic; the cheeks not very deep. *Rosy Razor-fish*, 207.

LL. Upper anterior profile of head sharply trenchant, its curve parabolic; cheeks very deep. *Pearly Razor-fish*, 208.



Cunner

Tautogolabrus adspersus (Walbaum)

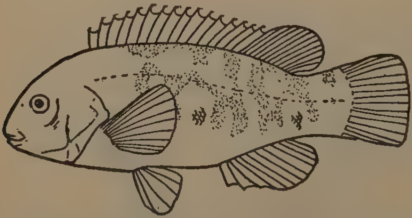
Occurs from Labrador to New Jersey and casually south to Chesapeake Bay. Resident in its normal range.

Common about wharves and docks and on rocky bottoms to about 35 fathoms.

Omnivorous, feeding on seaweed, hydroids, bryozoa, tunicates, annelids, crustacea, mollusks, fish, etc.

Spawns chiefly in June and early July. The eggs are buoyant, non-adhesive and average about .8 mm. in diameter. They hatch in about 40 hours at a temperature of 72° F. Maturity is apparently reached in the third year.

Reaches up to 15 inches and as much as 2½ pounds in the northern part of their range, but usually under a foot in the southern part. This is rather unusual, for the cunner belongs to an essentially tropical family, it being the most northern representative on our coast.



Tautog

Tautoga onitis (Linnæus)

LaMonte, Pl. 37

Occurs from New Brunswick to South Carolina. Most common between Cape Cod and the Delaware Capes.

Feeds largely on mollusks and crustaceans which its large powerful teeth are capable of crushing.

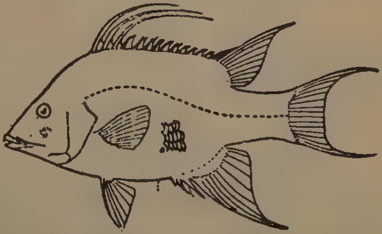
Spawns in June and early July. The eggs are non-adhesive and buoyant and average about 0.95 mm. in diameter. They hatch in about 43 hours at a temperature of 72° F. Maturity is probably reached in about three years and presumably spawning takes place in rather deep water as these fish are absent from shore waters during the summer.

Reaches a length of 36½ inches and a weight of 22½ pounds. This is a record and anything over 10 pounds is large for the species.

Hogfish

Lachnolaimus maximus (Walbaum)

LaMonte, p. 38



West Indies generally, abundant north to Florida and straggling to North Carolina.

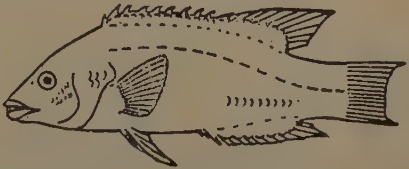
The sexes of this species are well marked by the fact that the cleft of the mouth in the male is very much wider than in the female. Both sexes show a remarkable ability to change both their color and pattern almost instantly. They usually run to combinations of red and its shades with various mottlings of lighter.

It is an excellent food fish.

Reaches a length of about 2 feet.

Spanish Hogfish

Bodianus rufa (Linnæus)



Common in the West Indies, reaching north to the Florida Keys.

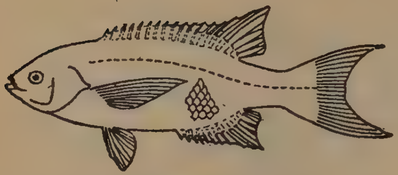
A handsome species usually a violet red anteriorly and abruptly yellow posteriorly.

Reaches a length of about 2 feet.

Cuban Hogfish *Decodon puellaris* (Poey)

A small West Indian species reaching north to Florida.

Too small to be of food value, usually not reaching 6 inches in length.

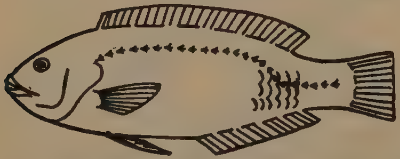


Creole

Clepticus parræ (Bloch & Schneider)

A comparatively rare species probably reaching Florida shores at times.

A small species scarcely reaching a foot in length.



Pudding-wife

Halichœres radiatus (Linnæus)

A good-sized West Indian form reaching Florida and straggling to North Carolina.

As with so many members of this family there are great changes in coloration, body proportions and shape of fins. It has only been established recently that the little slippery-dick is the young of this very differently colored and formed adult. However, even this is uncertain and what is here supposed to be the young may yet actually prove to be a small but distinct species.

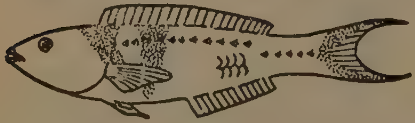
Reaches a length of about a foot and a half.

Painted Doncella *Halichœres pictus* (Poey)

West Indies, north to Pensacola, Florida.

This species is rare in our range. A handsomely colored fish in which the male differs considerably from the female.

Generally does not reach a foot in length.



Blue-head

Thalassoma bifasciatus (Bloch)

A common West Indian species reaching north to southern Florida.

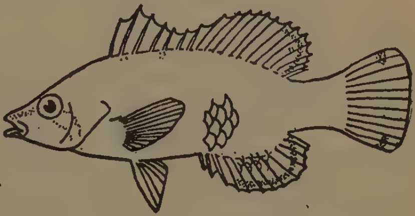
This species is remarkable for the change in color and shape of the tail correlated with size. In the very small and young there is a dark lateral stripe and the caudal is strongly convex. With growth the band breaks up into fragments which may elongate vertically somewhat and the tail becomes first truncate and then concave. With this occurs both a light and a dark phase. When the fish becomes adult it loses the stripe entirely, one of its fragments, just behind the head, becomes a vertical bar delimiting the color of the head from that of the body. The head becomes a bright blue and the body bright green. The caudal lobes become produced as filaments and are strongly edged with black.

This condition has naturally led to the description of a number of nominal species.

Reaches a length of about 6 inches.

Dwarf Wrasse

Doratonatus megalepis Günther



Known throughout the West Indies, north to the Florida Keys.

A little known form, probably the smallest of the wrasses, generally bright green in color. It is a handsome and striking little fish well marked in both color and form.

Does not reach over 3 inches in length.

Dwarf Razor-fish *Xyrula jessiæ* (Jordan)

Known only from off Tampa, Florida.

A rare and imperfectly known fish, bright red in color.

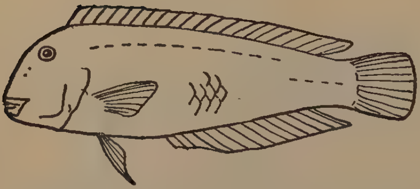
Reaches a little over 6 inches in length.

Rosy Razor-fish *Novaculichthys rosipes* (Jordan & Gilbert)

Known from the Bahamas and southern Florida.

A handsome but little known species with reddish fins.

Probably does not exceed 9 inches in length.



Pearly Razor-fish

Xyrichthys psittacus (Linnæus)

West Indies north to Pensacola, Florida.

A strikingly handsome species which lives between coral heads and broken or sandy bottom. It transports quantities of small fragments of coral with which it erects a "retreat" from which it normally never strays very far.

Reaches a length of about 15 inches.

The Parrot Fishes—*Family Scaridæ*

Tropical fishes with oblong, moderately compressed bodies, covered with large cycloid scales as in the wrasses. The teeth are fused at the base, at least, and usually into a parrot-like beak. The colors are generally brilliant but the sexes are, for most part, similar. They are not generally considered as good food fish, but they are by no means to be despised.

A. Teeth whitish or rosy; lower jaw projecting; lateral line subcontinuous; gill membranes not forming a fold across the isthmus, broadly jointed to it; scales about head few and large.

B. Dorsal spines flexible; teeth more or less distinct; lateral teeth of each jaw coalesced into a nearly continuous cutting edge, the anterior teeth free.

C. Posterior canines normally present.

D. Lateral teeth of lower jaw arranged in a series continuous with the anterior teeth; profile strongly convex above eye; posterior canine usually single.
Cuban Parrotfish, 210.

DD. Lateral teeth of lower jaw subequal, arranged in 2 rows which are not parallel; the posterior teeth of anterior series standing below and outside the anterior teeth of the posterior series; posterior canine usually 3 or 4, the first smallest; the upper lip double for its whole length.
Scorched Parrotfish, 211.

CC. No posterior canines; lateral teeth in each jaw subequal, those of the lower jaw larger than those of the upper and forming a continuous series; upper lip double for its entire length.
Emerald Parrotfish, 211.

BB. Dorsal spines stiff, pungent; teeth of each jaw coalescent; the jaws divided by a rather indistinct median suture.

E. Upper jaw normally with 1 or more canines above its cutting edge; colors usually bright.

F. Caudal truncate or slightly rounded, the angles not acute; 2 to 4 canines on each side; tubes of lateral line much branched; color very variable.
Radiant Parrotfish, 211.

FF. Caudal fin not truncate; lunate or forked, canines single.

G. Caudal fin lunate, the outer rays more or less produced, but not twice as long as the inner rays and much shorter than the head; color dark reddish-brown with white mottlings; fins usually plain red, the outlines of the scales well defined.
Red Parrotfish, 211.

GG. Caudal fin in adult deeply forked; the upper lobe about as long as the head and more than twice the length of the inner rays; opercle with a black spot, in front of which is a golden spot; gill membranes red; caudal with a red crescent at base separated from the bluish posterior margin by a green band.
Green Parrotfish, 212.

EE. Upper jaw without posterior canines; colors dull; usually olivaceous or reddish brown; caudal lunate or truncate with sharp angles (rounded in young).
Mud Parrotfish, 212.

AA. Teeth whitish, rosy green or blue; lower jaw included; lateral line interrupted behind, beginning again lower down on caudal peduncle; gill membranes forming a fold across isthmus; scales about head rather numerous, those on cheeks in 2 or more series; each jaw divided by a distinct median suture.

H. Teeth and jaws whitish or rosy in color.

I. Upper jaw with from 1 to 4 posterior canines.

J. Cheek with 2 to 3 rows of scales; head with a longitudinal band; a yellow longitudinal stripe on body; outer rays of caudal not colored like inner; caudal sub-truncate.

K. Outer rays of caudal blackish; inner greenish; 2 rows of scales on cheek; general color bright green, darker on back, paler below.
Bollman's Parrotfish, 212.

KK Outer rays of caudal orange, lighter than the inner; 2½ rows of scales on cheek; general color bluish green mixed with orange. *Ribbon Parrotfish*, 212.

JJ. Cheek with 4 rows of scales; no longitudinal band on head or body; a red band near edge of caudal; caudal with very salient angles; upper jaw with red and blue edgings; scales brown-edged.
Queen Parrotfish, 212.

II. Upper jaw without canines; 2½ rows of scales on cheek.

L. Third (partial) row of cheek scales of 3 or 4 scales; those of upper row little longer than those of second row; caudal slightly rounded, its outer rays not produced; sides of body with 2 broad dark longitudinal shades; sides of belly each with 3 sharply defined lines each on a row of scales (obsolete in old examples).

M. Stripes on breast whitish; color dark reddish brown above, paler below; caudal pale orange red; dorsal orange, edged with bluish. *Bahama Parrotfish*, 213.

MM. Stripes on breast blue; color bright green, olivaceous above, paler below; caudal green; dorsal green at least at base. *Evermann's Parrotfish*, 213.

LL. Third (partial) row of cheek scales 1 or 2 scales only; scales of the upper row much larger than those of the second row; caudal subtruncate, its outer rays more or less produced; color bright, rather uniform light blue, the young more or less shaded with reddish brown; fins chiefly blue.
Blue Parrotfish, 213.

HH. Teeth and jaws blue or bluish green.

N. Color olive green, each scale edged with clear brown; green markings on head; lower parts reddish, vertical fins all brownish orange edged with deep blue.
Rainbow Parrotfish, 213.

NN. Color almost uniform, deep bluish-purple tending almost to blackish in old examples.
Purple Parrotfish, 213.

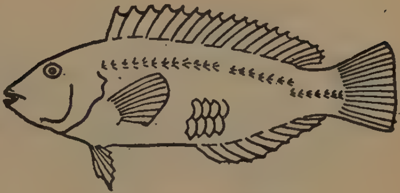
Cuban Parrotfish *Cryptotomus retractus* (Poey)

A rare West Indian species reaching north to Pensacola, Florida.

Probably does not reach over a foot in length

Scorched Parrotfish

Cryptotomus ustus (Cuvier & Valenciennes)



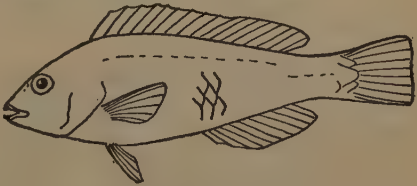
West Indies, north to Charleston, South Carolina.

Possibly the adult form of the following species.

Reaches less than a foot in length.

Emerald Parrotfish

Cryptotomus beryllinus Jordan & Swain



West Indies, the Florida Keys and rarely north to New Jersey.

Does not reach 9 inches in length unless identical with the preceding species.

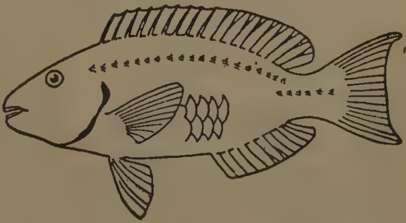
Radiant Parrotfish *Sparisoma radians* (Cuvier & Valenciennes)

West Indies and Southern Florida.

A common and exceedingly variable species that has been described under a large number of different names. Reaches a little over a foot in length.

Red Parrotfish

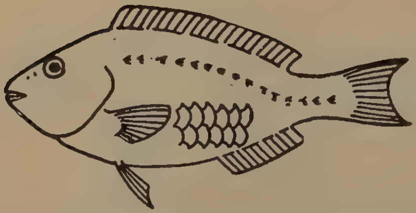
Sparisoma abildgaardi (Bloch)



General throughout the West Indies, north to Florida.

A small, fairly common and readily recognized species.

Does not exceed a foot at most.

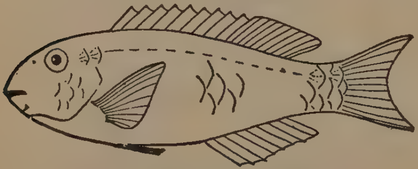


Green Parrotfish
Sparisoma viride
(Bonnaterre)

West Indies, north to Southern Florida.

An exceedingly brilliant species rare in our range.

Reaches somewhat over a foot in length.



Mud Parrotfish
Sparisoma flavescens
(Bloch & Schneider)

A West Indian species ranging from Rio de Janeiro to Florida with stragglers rarely to Massachusetts.

This is the most abundant member of the family about the Florida Keys and also the least gaudily colored.

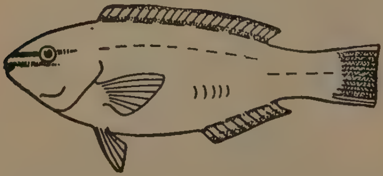
Rarely exceeds 1 foot in length.

Bollman's Parrotfish *Scarus bollmani* Jordan & Evermann

Known from the Gulf of Mexico in rather deep water. Sometimes taken off Tampa, Florida.

A rare species about which little is known.

Probably does not exceed 7 or 8 inches in length.



Ribbon Parrotfish
Scarus tæniopterus
Desmarest

A common West Indian species reaching north to Florida.

An exceedingly brilliantly marked form.

Apparently does not exceed a foot in length.

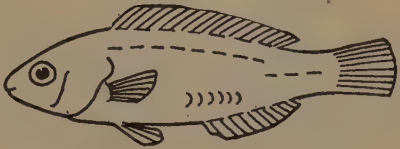
Queen Parrotfish *Scarus vetula* (Bloch & Schneider)

A common West Indian species reaching north to Florida.

A very handsome member of the family, predominately bluish.

Reaches a large size, some records exceeding 2 feet in length.

Bahama Parrotfish
Scarus croicensis
(Bloch)



A generally distributed species not uncommon about Florida.

Does not reach a large size, generally under 1 foot in length.

Evermann's Parrotfish *Scarus evermanni* Jordan

A little known form from off Tampa.

Very similar to the preceding species.

Does not reach as large a size.

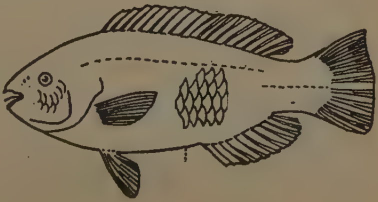
Blue Parrotfish *Scarus cæruleus* (Bloch)

Common in the West Indies, straggling as far north as Maryland. On one occasion, at least, it has been taken in numbers off Chesapeake Bay (1894).

The adults develop a great fleshy hump on the forehead, increasing in size with age.

One of the larger parrotfishes, at times reaching about 3 feet.

Rainbow Parrotfish
Pseudoscarus guacamaia
(Cuvier)



West Indies, north to Florida.

An exceedingly common and prominent form, reaching a large size. As with all the larger parrotfishes, it is quite able to bite through a small fish hook by virtue of its powerful beak.

Reaches over 3 feet in length; our largest parrotfish.

Purple Parrotfish *Pseudoscarus plumbæus* Bean

A rather rare West Indian species reaching the Florida Keys.

The exceedingly dark purplish-blue color which is fairly uniform all over will distinguish this species at once.

Reaches about a foot and a half in length.

THE SCALY-FINS—*Suborder Squamipinnes*

Deep bodied compressed tropical fishes with the vertical fins densely covered with scales.

A. Dorsal fins two; marked with vertical dark bars. *The Spadefishes*, 214.

AA. Dorsal fin continuous; not marked with vertical dark bars.

B. Teeth brush-like, setiform, thick set; maxillary distinct; caudal peduncle unarmed. *The Butterfly Fishes*, 215.

BB. Teeth incisor-like, in a single series; maxillary and premaxillary united immovably; caudal peduncle armed with an erectile spine on either side. *The Surgeonfishes*, 220.

The Spade Fishes—*Family Ephippidæ*

Tropical fishes, closely related to the angelfishes, but with two distinct dorsal fins. A single species in our region.

Spade Fish *Chætodipterus faber* (Broussonet)

Occurs from Cape Cod to Rio de Janeiro. Common in the West Indies.

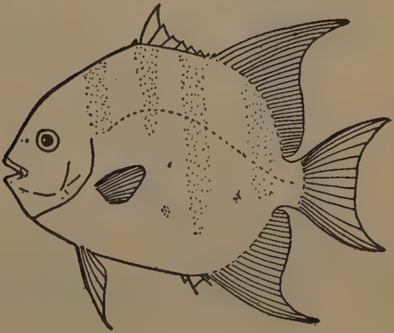
Feeds chiefly on invertebrates and is said to eat considerable numbers of the rather unsubstantial ctenophores (comb-jellies).

Capable of considerable pattern change. Usually barred with black and white, but sometimes nearly solid black or white.

Spawns from June to August in Virginia at least. The eggs are buoyant, non-adhesive and average about 1.25 mm. in diameter.

A food fish of considerable importance in the tropics.

Reaches a length of 3 feet although over 2 is unusual.



Spade Fish
Chætodipterus faber
(Broussonet)

The Butterfly Fishes—*Family Chætodontidæ*

Strongly compressed tropical fishes; covered with moderate or small scales, which are nearly smooth. Lateral line present, parallel with dorsal outline; mouth small, terminal, armed with small setiform (brush-like) teeth. They inhabit reefs and rocky places and are exceptionally quick in movement. They are usually brilliant in color and the young are generally quite differently marked than the adults.

A. Preopercle unarmed; dorsal spines not graduated, some of the median spines longer than the last; scales comparatively large; dorsal spines 12 to 14.

B. Series of scales below axis of body running obliquely upward and backward, the lowest becoming more or less horizontal; an ocular band from nape to cheek.

C. Base of soft dorsal with a large black spot, not ocellated. *Common Butterfly Fish*, 217.

CC. Soft dorsal and anal without black; no humeral band, ocular band jet-black. *Bank Butterfly Fish*, 217.

BB. Series of scales below axis of body extending downward and backward, forming an angle with those above, each series marked by a continuous dark streak.

D. Body without ocelli, crossed by dark bands. *Banded Butterfly Fish*, 217.

DD. Body with a large ocellus below soft dorsal. *Four-eyed Butterfly Fish*, 218.

AA. Preopercle armed at its angle with a very strong spine which is sometimes grooved; anterior part of soft dorsal falcate; dorsal spines 8 to 14.

E. Interopercle unarmed; vertical limb of preopercle above spine entire or nearly so; dorsal spines 8 to 10; soft rays 29 to 32.

F. Scales in lateral line about 50 to 55; dorsal rays usually 30 or 32, anal 24; color of adult steel-gray or slightly yellowish; young with 4 whitish cross bands. *Black Angelfish*, 218.

FF. Scales in lateral line 70 to 90; dorsal rays 29 or 30, anal 23 or 24; color of adult black with each scale edged with yellow; base of pectoral yellow; young with several yellowish cross bands. *French Angelfish*, 219.

EE. Interopercle short and broad; armed with 1 to 4 strong spines; preopercle serrate or spinous; dorsal spines about 14, graduated; the last longest; scales rather small; isthmus very narrow.

G. Vertical limb of preopercle simply serrate, with 10 to 30 small teeth; body oblong, rather robust; anterior part of body black, posterior abruptly yellow; dorsal, anal and opercle edged with scarlet. *Rock Beauty*, 219.

GG. Vertical limb of preopercle with 3 to 9 conspicuous spines; body ovate, much compressed; fins chiefly bright yellow edged with brilliant blue.

H. A conspicuous blue ocellus on nape; ascending limb of preorbital with about 10 strong radiating spines; preopercular spines 3 in head (measured along groove) pectorals and caudal yellow. *Queen Angelfish*, 219.

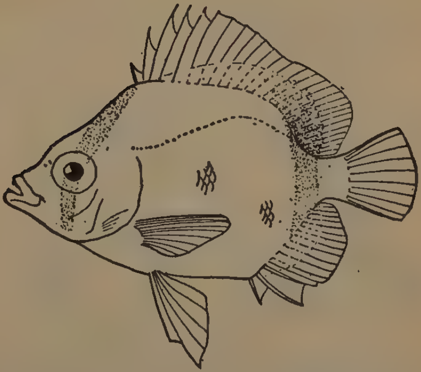
HH. No ocellus on nape; ascending limb of preorbital without spines; preopercular spine 4 to 5 in head.

I. Pectorals and caudal bright lemon yellow; 4 anal spines. *Townsend's Angelfish*, 220.

II. Pectorals and caudal only edged with yellow; 3 anal spines. *Common Angelfish*, 220.

Common Butterfly Fish

Chætodon ocellatus Bloch



A West Indian species straying northward to Massachusetts.

A typical reef species flitting about from place to place in a rather butterfly-like fashion.

Reaches a length of about 8 inches.

Bank Butterfly Fish *Chætodon aya* Jordan

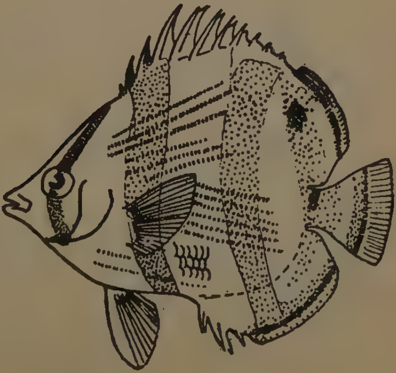
A rare form from the Gulf of Mexico, chiefly from fishing banks in rather deep water.

Known only from very small specimens.

They may represent the young of some other species.

Banded Butterfly Fish

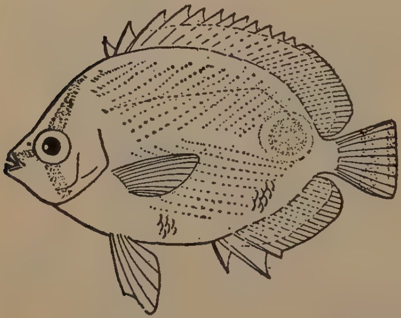
Chætodon striatus Linnæus



A West Indian form rather rare in southern Florida.

Feeds on animal and vegetable matter.

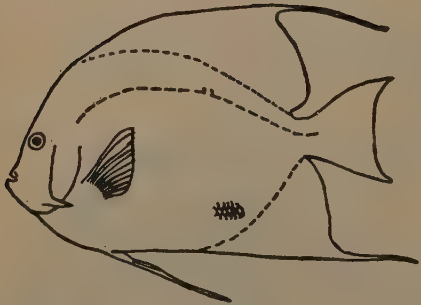
Reaches a length of about 6 inches.



Four-eyed Butterfly Fish

Chætodon capistratus
Linnæus

A West Indian species straggling rarely northward to Massachusetts. Common in southern Florida.



Black Angelfish

Pomacanthus arcuatus
(Linnæus)

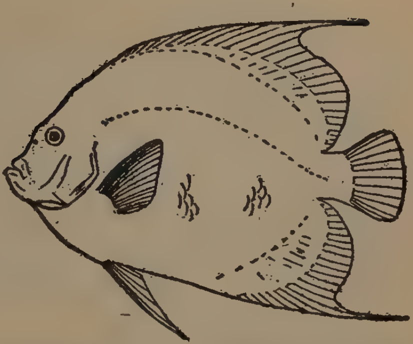
A West Indian species, extending from Bahia, Brazil, accidentally northward to New York.

A common species about the Florida reefs, but not valued as food.

Feeds mostly on invertebrates and vegetation.

Reaches a length of 2 feet.

French Angelfish
Pomacanthus paru
(Bloch)

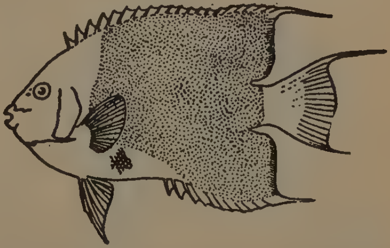


A West Indian species reaching north to southern Florida. Not uncommon about Key West.

A handsome species especially when young and showing the several vertical yellow lines. Not valued for food

Reaches a length of a little over a foot.

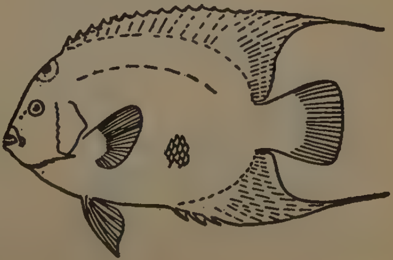
Rock Beauty
Holocanthus tricolor
(Bloch)



One of the most striking West Indian reef fishes. Rare about the Florida Keys.

Reaches a length of somewhat over a foot.

Queen Angelfish
Angelichthys ciliaris
(Linnæus)



A West Indian species reaching Florida.

This is a large showy fish predominantly blue and yellow in color. It is a good food fish as are the two following species, all of which resemble one another in general outline and coloration although they may be readily distinguished in the field by the fact that the common angelfish has the tail and pectorals only edged with yellow whereas in the other two these entire fins are bright lemon. The queen angelfish has a conspicuous dark blue ocellus on the nape and Townsend's has none. The present species is much less common in our range, at least, than the common angelfish.

Reaches a length of nearly 2 feet.

Townsend's Angelfish *Angelichthys townsendi* Nichols & Mowbray

Known only from the Florida Keys.

In its territory this species is about as common as the queen angelfish.

It apparently does not reach so large a size as the former, seldom being seen over a foot in length.

Common Angelfish *Angelichthys isabelita* Jordan & Ritter

Known from the West Indies, Florida and Bermuda, where it is the only representative of the genus.

Although not as vividly marked as the two preceding species it is a strikingly colored fish. It is noteworthy in this connection that the brilliant yellow of these fishes is due to the presence of bright yellow pigment (xanthine) whereas the equally brilliant blue is an interference color, *i.e.*, it is due to the splitting up of light by minute crystals of guanine, a substance chemically close to that of guano which is deposited by sea birds. Most colors thus produced change with the angle of vision but the structures of the interfering substances in this case are so arranged as to "throw back" the same shade of blue from practically any angle.

Incidentally, nearly all fish colors are produced by one of these two methods.

Reaches a length of about 18 inches.

The Surgeon Fishes—*Family Acanthyridæ*

Compressed tropical fishes, usually covered with very small scales. The caudal peduncle is armed with a single erectile lancet-like spine. This is directed forward and when erected enables the fish to inflict deep gashes by "side-swiping" its adversary. For this reason they are a trouble to those concerned with keeping them in aquaria as they are apt to be quarrelsome and can mortally wound each other in a surprisingly short time.

A. Outline rhomboid, the depth about 1½ in length; color brown, washed with deep blue; dorsal rays 27; anal 24. *Blue Tang*, 221.

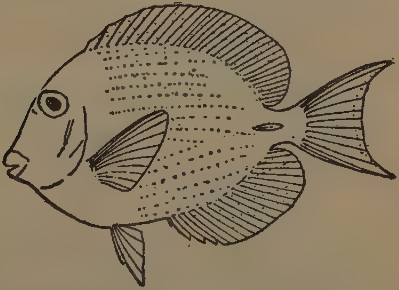
AA. Outline ovate, the depth about 2 in length; color brown, never blue.

B. Caudal lunate; dorsal rays 26; anal 24. *Doctor Fish*, 221.

BB. Caudal deeply emarginate; upper lobe of caudal produced in a filament; dorsal rays 24; anal 22. *Ocean Surgeon*, 222.

Blue Tang

Acanthurus cæruleus
Bloch & Schneider

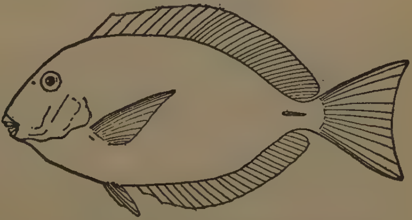


Occurs in the West Indies, from Bahia, accidentally northward to New York. Common about Florida.

Reaches a length of about 1 foot.

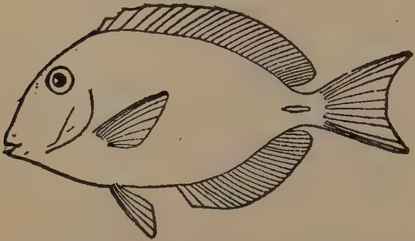
Doctor Fish

Acanthurus hepatus
(Linnæus)



West Indian, known from Bahia to Florida, accidentally north to Massachusetts.

The most common species of the family in our region. Reaches a length of about 10 inches.



Ocean Surgeon
Acanthurus bahianus
Castelnau

Known from Bahia to Florida and casually northward to Massachusetts.

Tends to keep more offshore than the other species.

Reaches a length of about 1 foot.

THE TRIGGERFISHES—*Suborder Sclerodermi*

Deep bodied compressed fishes, with at least one spine in dorsal which is greatly enlarged and inserted far forward.

A. First dorsal composed of 3, rarely 2 spines, the first very large, the second locking it in erection; scales large and bony, rough. *The Triggerfishes*, 222.

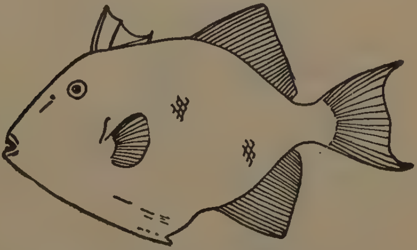
AA. First dorsal of a single strong spine, with a rudiment at its base; scales minute but spiny so that the sides are slightly rough. *The Filefishes*, 224.

The Triggerfishes—*Family Balistidæ*

Essentially tropical fishes ranging northward as accidentals. Characterized by the peculiar first dorsal fin of three spines to which the common name refers. The anterior and largest spine "locks" in position when erect and cannot be folded back by external pressure, usually breaking off if sufficient force is applied. The third spine, however, may be depressed freely with the finger and when this is done the first spine automatically folds down with it. This condition is made possible by virtue of a complicated interlocking arrangement.

at the bases of the spines, which in a machine would surely be considered as highly ingenious. The spines may be thought of as a protection against aggressors but the possible function of this trigger-like arrangement, operable externally is unknown. In common with the file fishes the present family has an erectile ventral flap. These fishes are relished where found, the tough leathery, but yet scaly skin, being usually stripped off in a single piece. Two genera are known from our area and others occur just to the southward which may be expected to wander into it at times.

A. Gill opening with a number of large bony plates behind it.
B. Color dull brown or gray sometimes somewhat mottled. *Common Triggerfish*, 223.
BB. Covered with bluish-black spots on a brownish yellow. *Spotted Triggerfish*, 223.
BBB. Colors brilliant prominent blue lines on face. *Queen Triggerfish*, 224.
AA. Gill opening with only ordinary scales behind it, colors dull, scales with keel like ridges. *Ocean Triggerfish*, 224.

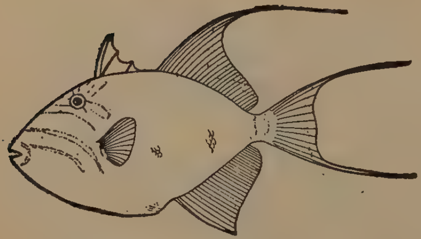


Common Triggerfish
Balistes carolinensis Gmelin

Common on the tropical and sub-tropical shores, drifting northward on the Gulf Stream in late summer and fall. Records for New York and Massachusetts are not rare. Reaches about a foot in length.

Spotted Triggerfish *Balistes forcipatus* Gmelin

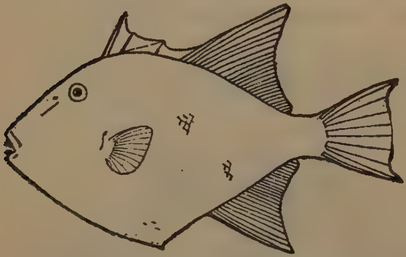
A west African form rarely straying to our shores, has been recorded off Rhode Island, rather similar to the common triggerfish except in coloration.



Queen Triggerfish

Balistes vetula
Linnæus

A brilliant tropical species, capable of considerable and rapid color change. Common about Florida, straying northward to Massachusetts. Reaches about a foot and a half in length. The first ray of the soft dorsal and the two outer caudal rays are produced into long filaments in the adults.



Ocean Triggerfish

Canthidermis sabaco
Poey

One of the largest of the triggerfishes reaching a length of 2 feet. Generally more offshore in habit than the others here mentioned. One record as far north as Massachusetts but not common north of Florida.

The File Fishes—*Family Monacanthidæ*

Close relatives of the triggerfishes which have but a single well developed dorsal spine and lack the trigger-like arrangement that characterizes the preceding family. The name is derived from their hard rough skin which formerly, at least, was used as an abrasive in a manner similar to sand paper. Even today many old fishing smacks have pieces of such hide tacked up by their stoves as match scratchers. None are valued as food. Some members of this family are more common northward than any of those of the preceding family, but this group should also be considered as primarily a tropical aggregation. There is a prominent erectile ventral fold operated by a long backwardly projecting bone which may be felt through the skin.

A. Gill opening short nearly vertical, a small moveable spine at the end of the bone supporting the ventral pouch.

B. Dorsal spine not barbed; merely roughened. *Gray Filefish*, 225.

BB. Dorsal spine armed with strong retrorse horns, generally in two series.

C. Ventral flap greatly developed, extending much beyond the small spine and with its edge strongly convex, a few recurved spines on the caudal peduncle. *Fringed Filefish*, 226.

CC. Ventral flap not reaching beyond pelvic spine, its edge nearly straight, no spines on peduncle. *Common Filefish*, 226.

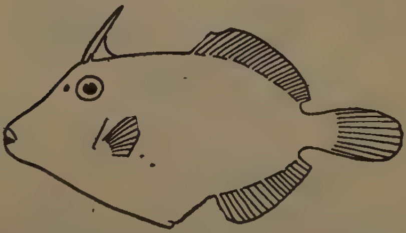
AA. Gill opening long and oblique, no pelvic spine.

D. Dorsal rays I—36 anal 38, coloration variously mottled with orange, black and tan. *Orange Filefish*, 227.

DD. Dorsal rays about 1—46, anal rays about 50.

E. Upper profile of snout concave, caudal with rounded angles, elongate, body with irregular blue spots. *Scrawled Filefish*, 227.

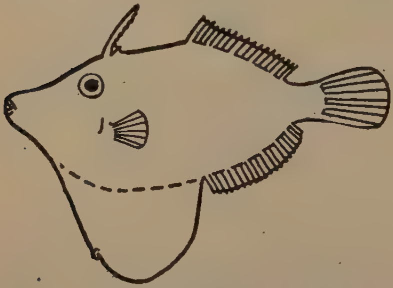
EE. Upper profile of snout convex, caudal short, with comparatively abrupt angles, body mottled. *Unicorn Filefish*, 227.



Gray Filefish

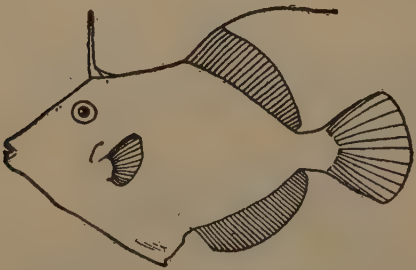
Cantherines pullus
(Ranzani)

A rare West Indian species, occasionally reaching Florida. Dorsal fin II–35, Anal 31. Generally a whitish spot behind the last dorsal ray, other colors variable. Reaches over a foot in length.



Fringed Filefish
Monocanthus ciliatus
(Mitchill)

Common in Florida waters but does not usually reach far northward. Rarely recorded to Cape Cod and the Gulf of Maine. The young may always be distinguished from the common filefish by their convex ventral flap and usually by the recurved barbs on the caudal peduncle. Generally there is a distinct dark spot on the flap that is usually not present on that of the common filefish. Reaches a length of 8 inches.

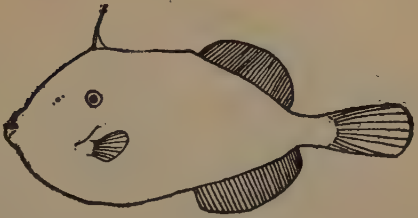


Common Filefish
Stephanolepis hispidus
(Linnæus)

A widely distributed species, often found in company with the fringed filefish in Florida. There are numerous records from as far north as the Gulf of Maine. Generally a slaty gray but capable of considerable change of shade. The young, at least, may even be a bright green when taken in beds of seaweed (*Ulva* etc.). Reaches a length of about 10 inches.

Orange Filefish

Ceratacanthus schœpfii
(Walbaum)



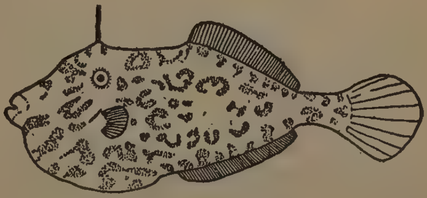
A widely distributed form found along our shores from Maine to Texas. As with the other members of this family it feeds chiefly on marine growths such as generally grow on pilings in suitable waters. Around places of this sort it may be frequently seen cropping off the sedinary plants and animals with the sharp teeth that beset its very small mouth. The awkward movements displayed on account of the ungainly shape, are rather striking and as it slowly pokes its way about there is nothing unusual in finding it pointing head down for long periods of time. Reaches a length of about 2 feet.

Scrawled Filefish *Ceratacanthus scripta* (Osbeck)

A less common West Indian species reaching as far north as South Carolina. Questionably recorded from New York. Reaches about 3 feet in length.

Unicorn Filefish

Ceratacanthus monoceros
(Osbeck)



Cosmopolitan in warm seas. Rarely reaches our shores from the West Indies. Recorded as a straggler as far north as Massachusetts. Reaches a length of 2 feet.

THE TRUNKFISHES—*Suborder Ostracodermi*

A curious group of hard shelled fishes encompassed in a single family.

The Trunkfishes—*Family Ostraciidæ*

Small-mouthed fishes encased in a hard shell formed by a fusion and solidification of the scales. This shell is a rigid test perforated only for the protrusion of the fins, eyes, mouth, etc., which is triangular in cross section, with one apex upward. The very young, however, are nearly spherical in outline, the ridges forming the angles later in life barely showing at all. Small ones of a half inch or so are not infrequently carried northward on the Gulf Stream from their home waters in the West Indies and about Florida. They are naturally very sluggish fishes, being capable of no contortions of the body itself for propulsive purposes. They are excellent food fishes and are often baked or roasted in the shell they are provided with. All in our waters belong to a single genus, *Lactophrys*.

A. Carapace (shell) without any spines at all. *Smooth Trunkfish*, 228.

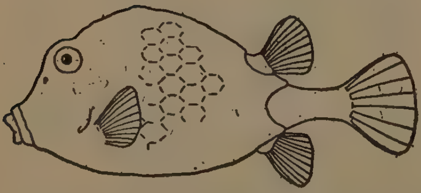
AA. Carapace with a distinct spine at both lower posterior angles, just before the anal fin pointing backward.

B. No spines over eyes.

C. Carapace closed behind dorsal fin, body covered with round dark spots. *Shellfish*, 229.

CC. Carapace open behind dorsal fin (*i.e.* with a little "island" of shell behind the dorsal not connected with the main shell) body mottled with paler. *Common Trunkfish*, 229.

BB. Two strong spines over eyes, directed forward. *Cowfish*, 229.



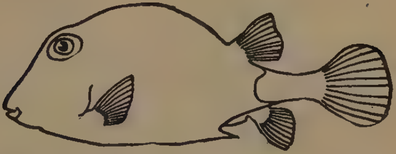
Smooth Trunkfish

Lactophrys triqueter (Linnæus)

Very common in the tropics on sandy patches between reefs. Normally reaches north only to Florida, but has been recorded from Massachusetts. Attains a length of over ten inches.

Shellfish

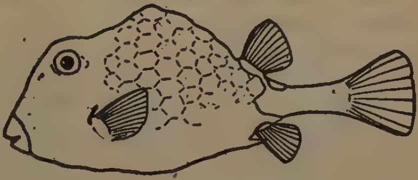
Lactophrys bicaudalis (Linnæus)



One of the larger, rarer and more valued species. Reaches a length of 16 inches. Often taken in Florida but is common only south of our region.

Common Trunkfish

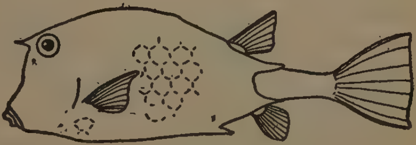
Lactophrys trigonus (Linnæus)



Very common in Florida waters, but reaches northward as far as Massachusetts. This is the form most frequently wafted northward from their spawning beds before they were able to stem even the gentlest flow. Reaches a length of 9 inches. Only those of one inch or under have been recorded to the north however.

Cowfish

Lactophrys tricornis (Linnæus)



A common species north to the Carolinas from where it struggles as far north as Massachusetts. Reaches a length of over a foot or more.

THE SWELLFISHES—*Suborder Gymnodontes*

A highly specialized group of fishes characterized by a fused parrot-like beak and usually the ability to inflate themselves.

A Caudal region normally developed, with a caudal peduncle; the body not compressed.

B. Upper and lower jaw each divided by a median suture; body covered with small prickles or naked. *The Swellfishes*, 230.

BB. Upper and lower jaw undivided; body covered with large thorn-like spines. *The Porcupine Fishes*, 234.

AA. Caudal region aborted, the body truncate behind; body somewhat compressed. *The Ocean Sunfishes*, 236.

The Swellfishes—*Family Tetraodontidæ*

Short bodied thickish fishes with the curious ability of inflating a sac-like process of the gullet in such a manner that in the extreme cases the fish assumes a nearly spherical outline. This is accomplished by a special manipulation of the breathing valves so that air or water, depending upon which they are in at the time of inflation, fills this sac and distends the abdomen to grotesque proportions. This act is generally only performed when the fish is frightened or handled and is supposed to be a protection against predacious enemies. The scales are usually modified into rather small prickles which, when the fish is fully inflated, stand out along radii of the sphere. The exact method by which the breathing apparatus is made to inflate the fish has never been determined. The flesh of some of these fishes is supposed to be poisonous, although they are eaten with relish by certain epicures. It is not clear just what part, if any, contains toxic substances in most of these fishes although it is wise for the gastronomic experimenter to proceed with extreme caution. What there is of the flesh is practically in one piece for the ribs are reduced to mere vestigial swellings on the vertebræ. The teeth are fused into a beak-like structure that is very powerful. There is always a median suture in both the upper and lower jaws which serves to distinguish this family from the Diodontidæ which are somewhat more specialized and lack this median suture. This family is essentially a tropical one, and there reaches its greatest numbers in both species and individuals although some of the forms reach well to the northward.

A. Nostrils with two distinct openings on each side, usually with a more or less distinct tube.

B. Body comparatively elongate, dorsal and anal fins rather long, each with 12 to 15 rays, lower sides of tail with a cutaneous fold. *Smooth Swellfish*, 231.

BB. Body oblong, plump; dorsal and anal of fewer rays, 6 to 8; lower sides of tail without a distinct fold.

C. Skull narrow above, interorbital area more or less concave, 2.5 to 6.5 in snout, 5 to 12 in head, sides of body usually with small dermal flaps, a series of dark spots bounding ventral outline.

D. Sides of head and body always smooth except sometimes a strip behind pectorals.

E. Caudal with a broad dusky band at base and tip, body variously mottled. *Southern Swellfish*, 232.

EE. Caudal plain, body marked with small faint greenish broken circles. *Harper's Swellfish*, 232.

DD. Sides of head and body always prickly as is back from upper lip to base of dorsal.

F. Interorbital less than 2 in eye; prickles thick set above as well as below interorbital a little less than eye, about a dozen irregular dark spots along edge of light under side. *Northern Swellfish*, 232.

FF. Interorbital 2 or over in eye.

G. Prickles wide set above about a dozen irregular dusky spots along under side, no net work of pale lines. *Florida Swellfish*, 233.

GG. Prickles crowded anteriorly above, scattered posteriorally, an irregular net work of pale lines separating the dark spots on lower side. *Marbled Swellfish*, 233.

CC. Skull very broad above, flattish, little concave interorbital more than .5 of snout, 2.5 to 4 in head, sides with no series of dark spots bounding ventral surface.

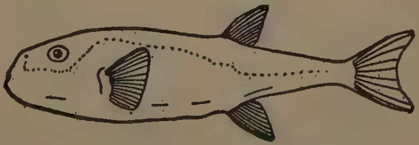
H. Eye 7.5 in head, small prickles on nape, caudal rounded *West Indian Swellfish*, 234.

HH. Eye 3.5 in head, fine long bristle-like spines on nape, caudal truncate. *Hairy Swellfish*, 234.

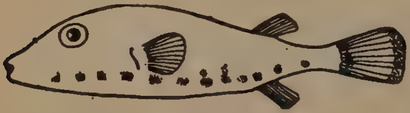
AA. Nostrils single on each side, without a distinct tube or tentacle. *Sharp-nosed Swellfish*, 234.

Smooth Swellfish

Lagocephalus lævigatus
(Linnæus)



Not common north of Cape Hatteras. This is one of our largest swellfishes, but inflates itself to the least extent of any of our species. The ventral pouch distends as a great swelling, but it does not destroy the remainder of the fish's outline. Records extend as far north as Massachusetts. In color it is greenish gray above and silvery below. There are only a few scattered prickles on the ventral surface. Attains a length of 2 feet.



Southern Swellfish

Sphĕroides spengleri (Bloch)

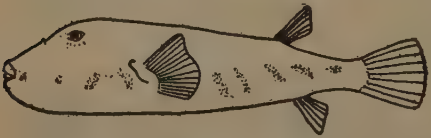
A widely distributed species in the tropical Atlantic, common on our coast as far north as Florida. From there northward it becomes less common, reaching Massachusetts as a casual visitor. Reaches a length of a foot, but by far the most to be seen in collections are much smaller.

Harper's Swellfish *Spheroides harperi* Nichols

Known from southern Florida.

Very similar to the northern swellfish in appearance but with the prickles wider set. It is possible that this form intergrades with the northern swellfish and that southern records of the latter actually refer to the form here called *harperi*. At Key West, Florida, there are either two species confused under this name or it appears in two phases. One is quite destitute of prickles and the other well covered. These differences are recognized by the fisherman for it is exceedingly difficult to hold one of the smooth ones when inflated. Externally these two forms are otherwise identical.

Reaches a length of about 10 inches.



Northern Swellfish

Spheroides maculatus (Bloch & Schneider)

The most northernly species of our coast. It breeds regularly at least as far north as New York, and is taken occasionally off the Maine coast. In common with most of its congeners it spends much of its time poking about sandy shores and is able to partly bury itself by means of its specialized clavicles which are operable somewhat as shovels because of the loose and baggy nature of the skin covering the ventral surface. Along the New Jersey and New York coast at least they spawn for the most part in early summer. The eggs are tiny and adhesive, adhering to anything in which they come in contact. They hatch in about 4½ days into active larvæ that do not resemble their parents in the least but by the time a quarter of an inch has been reached they look like their parents in all essential respects and are able to inflate themselves into a tiny ball about the size of a pea. The capacity for inflation in this species may be indicated by the following figures.

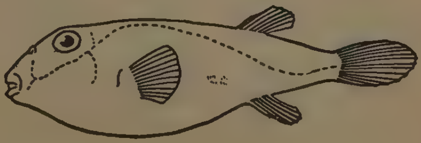
Length of fish in mm.	Capacity in fluid oz.
99	4.75
169	21.25
215.5	40.00

The measurement is to the base of the tail fin.

They reach a length of about 10 inches. Their food, as is common with the entire group consists largely of crustaceans and mollusks although they are likely to eat most anything available. It is not an uncommon sight to see a group of them "mob" a solitary blue crab and in an exceedingly short time dispatch him, for their hard cutting jaws are well able to bite through the resistant shell, although they are not fond of being nipped by the sharp chæla of the crab and will seldom tackle one alone. The spectacle always suggests concerted action and the possession of more reasoning power than we have any right to assign to such a fish.

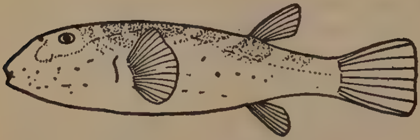
Florida Swellfish *Spheroides nephelus* (Goode & Bean)

A rare species known only from Florida waters. The coloration suggests the preceding northern species rather than any of the adjacent forms.



Marbled Swellfish
Spheroides marmoratus
(Ranzani)

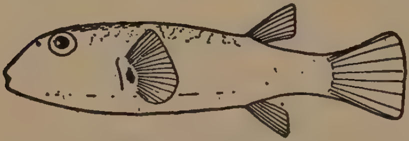
Properly a form south of our region but very apt to occur along the Gulf coast or the southern tip of Florida.



West Indian Swellfish

Spheroides testudineus (Linnæus)

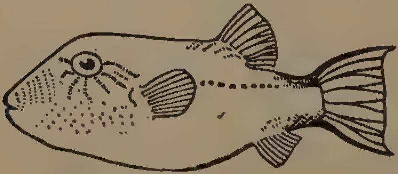
Fairly common on the Florida Keys, and once, at least, carried northward on the Gulf Stream as far north as Rhode Island.



Hairy Swellfish

Spheroides trichocephalus (Cope)

Known only from one specimen taken off Rhode Island, but very likely a tropical species carried far off its normal range.



Sharp-nosed Swellfish

Canthigaster rostratus (Bloch)

Properly a West Indian form, but known from the snapper banks off Pensacola. Not known to attain as high as 6 inches in length.

The Porcupine Fishes—*Family Diodontidæ*

Primarily tropical fishes related to the preceding family and possessing an equal faculty for inflation; generally provided with more prominent spines. They are readily distinguished from the preceding family by the fact that the fused jaw teeth lack a median suture, each jaw being simply a solidly formed beak-like structure. In habits and general structure they resemble the swellfishes to a considerable extent.

A. Dermal ossifications sharp spines, erectile or fixed.

B. Dermal ossifications, mostly two rooted, the spines slender and quill like, erectile. *Porcupine Fish*, 235.

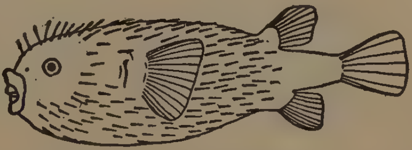
BB. Dermal ossifications all or nearly all three rooted, each with a stiff immovable spine, not erectile.

C. Upper parts greenish with a series of undulating dark lines running backward from the nape, an ocellated spot above pectoral, fins unspotted. *Spiny Boxfish*, 235.

CC. Upper parts densely covered with dark spots, a large dark blotch before dorsal, on each side and above gill openings, fins spotted. *Spotted Boxfish*, 236.

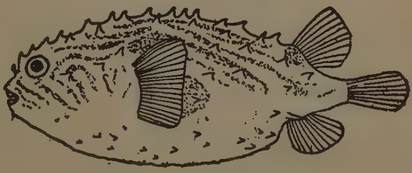
AA. Dermal ossifications, flattish, papery or cartilagenous plates with minute hair-like papillæ, covered with dark circles. *Smooth Boxfish*, 236.

Porcupine Fish
Diodon hystrix
Linnæus



This species and others close to it are the forms usually hollowed out in an inflated condition for the purpose of making "Japanese" lanterns. The custom doubtless arose in Japan although now common in the West Indies. When inflated, with their long quills sticking out all around this species is exceedingly well protected, for few animals, including man, are inclined to bother it. The spines are capable of inflicting painful wounds. It occurs in all tropical seas and is taken regularly as far north as Florida rarely drifting further but only occasionally as far as Massachusetts. Reaches a length of about 3 feet.

Spiny Boxfish
Chilomycterus schœpfii
(Walbaum)



This form ranges more to the northward than any other species of the family and is occasionally taken at Cape Cod.

When handled it is not as apt to inflate itself as promptly as most of the other inflatable species but can do so to a prominent extent when sufficiently disturbed. It reaches a length of about 10 inches. It is a regular late summer and fall visitor to the waters about New York. It is doubted whether the West Indian boxfish *C. antillarun* Jordan and Rutter properly belongs in this list, if indeed it is a valid species. It differs chiefly in color and the present form is subject to great variation.

Spotted Boxfish *Chilomycterus atinga* (Linnæus)

A West Indian form known from the Florida Keys. Not a common species within the range of this list.

Smooth Boxfish *Læosphæra globosa* Evermann & Kendall

Known only from a few records along the southern tier of states. A rare species, apparently of small size, about two inches. Possibly the young of one of the boxfishes.

The Ocean Sunfishes—*Family Molidæ*

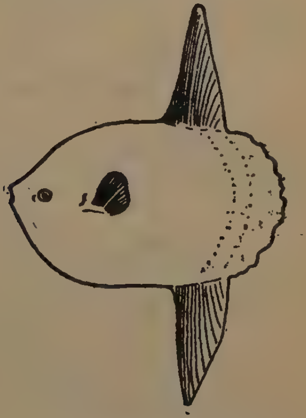
Immense pelagic fishes, not in danger of being confused with any other group. The body is terminated abruptly, close behind the dorsal and anal fins, in a manner that suggests that it has been cut off. They are sometimes stranded on beaches but more frequently brought in by harpooners who have been impressed by their large size and bizarre appearance. The skeleton is degenerate, to the consistency of tough cheese, and presents no especial resistance to a knife.

A. Body about as high as long, skin tough leathery. *Ocean Sunfish*, 236.

AA. Body about twice as long as high, skin smooth and covered with smooth hexagonal plates. *King-of-the-Mackerels*, 237.

Ocean Sunfish *Mola mola* (Linnæus)

Found occasionally along our entire coast as far north as the Gulf of St. Lawrence. The very young are quite different, being spheroidal in shape and covered with numerous spines. The food consists of jellyfish, small crustaceans and similar organisms. The largest on record (from California, the species being cosmopolitan) was estimated at over 2,000 pounds and measured 10 feet, 11 inches long.



Ocean Sunfish
Mola mola (Linnæus)

King-of-the-Mackerels *Ranzania truncata* (Retzius)

This form also reaches a large size and is cosmopolitan in distribution. It is known from only a few specimens and we have no definite records of it off our coast but it is likely to turn up at any time in the warmer seas.

The Mail-cheeked Fishes—*Suborder Loricati*

A group of rather rough and spiny fishes in which a bony stay extends across the cheeks (the third suborbital).

A. Ventral fins not united as a sucking disk; spinous dorsal well developed.

B. Anal with 3 strong spines; body covered with scales. *The Scorpion Fishes*, 238.

BB. Anal without any spines; body not uniformly scaled. *The Sculpins*, 241.

AA. Dorsal spines little developed or absent.

C. Ventral fins not united in a sucking disk; scales developed as plates arranged in 8 longitudinal rows *The Sea Poachers*, 245.

CC. Ventral fins united into a sucking disk.

D. Caudal region short; body covered with horny processes. *The Lump Fishes*, 246.

DD. Caudal region elongate; skin smooth. *The Sea Snails*, 247.

The Scorpion Fishes—*Family Scorpænidæ*

Fishes with heavy armored heads, covered with spines. Bottom fishes, for most part sedentary in nature, sometimes of a brilliant color.

A. Dorsal XV, 13; anal III, 7; pectorals long, narrow; color uniform orange-red. *Rosefish*, 239.

AA. Dorsal XII, 13; anal III, 5; 2 pairs of spines over occiput; scales on body ctenoid or with dermal flaps, those in head cycloid or wanting.

B. Occiput with a distinct quadrate pit.

C. Supraocular tentacle less than twice diameter of orbit' dorsal XII, 10.

D. Anterior border of orbit with no distinct pit below it; suborbital with 3 distinct spines; third anal spine longer and stronger than second.

E. Eye less than 3.7; supraorbital cirrus less than 2.5; chin not especially prominent. *Brazilian Scorpion Fish*, 239.

EE. Eye 3.7; supraorbital cirrus 2.5; chin prominent. *Cole's Scorpion Fish*, 239.

DD. Anterior border of orbit with a distinct pit between it and suborbital stay; surborbital stay with 3 or 4 blunt spines; second anal spine slightly larger than third. *West Indian Scorpion Fish*, 239.

CC. Supraocular tentacle more than twice diameter of eye; flaps on lateral line larger than eye; suborbital stay with a small spine near its center; another at its posterior end; axil gray with many small white spots; dorsal XII, 9. *Lion Fish*, 240.

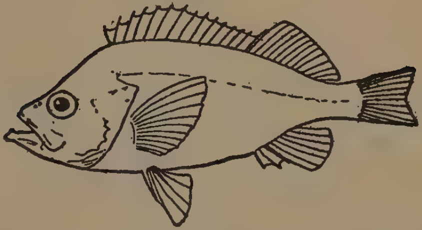
BB. Occiput with a very shallow or no depression.

F. Occiput with a very shallow, but distinct depression; pectoral with 6 branched rays; dorsal XII, 10. *Red Scorpion Fish*, 240.

FF. Occiput with no depression; pectoral with 2 branched rays; dorsal XII, 8. *Unarmed Scorpion Fish*, 240.

Rosefish

Sebastes marinus
(Linnæus)



Occurs on the coasts of the North Atlantic as far south as Maine and in deeper water as far south as New Jersey. It is seldom found in water over 50° F.

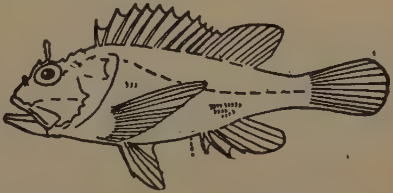
Feeds largely on small crustaceans and to a certain extent on fishes.

The eggs are supposed to hatch within the body of the female which then brings forth living young.

Reaches a length of about 2 feet.

Brazilian Scorpion Fish

Scorpæna braziliensis
Cuvier & Valenciennes



Known from South Carolina to Rio de Janeiro, but not very common in our range.

The sharp spines of this and the other members of the family are capable of inflicting painful wounds.

Reaches about a foot in length.

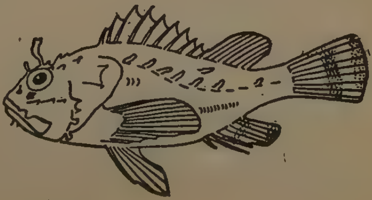
Cole's Scorpion Fish *Scorpæna colesi* Nichols

Known only from North Carolina. Rare.

Similar to the Brazilian scorpion fish but probably inhabiting deeper water.

West Indian Scorpion Fish

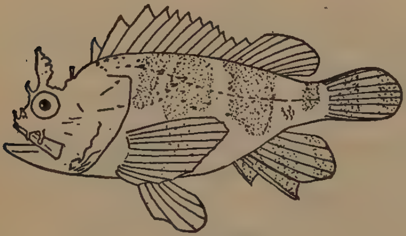
Scorpæna plumeri
Bloch



Occurs in the West Indian region from Brazil to Florida straggling northward, sometimes to Massachusetts.

A rather repulsive creature, but nevertheless handsomely marked, being variously mottled with reds and blues. The inside surface of the pectoral is largely yellow. When the fish moves these fins it thus displays this as a "flash" color.

Reaches a length of about 1 foot.



Lionfish
Scorpæna grandicornis
Cuvier & Valenciennes

Occurs in the West Indies from Brazil to Florida, sometimes reaching as far north as Katama Bay, Maine.

Our most striking member of the family being covered with variously formed dermal tabs, which combined with its chunky head and mottled coloration gives it a very "shaggy" appearance.

Reaches a length of about 8 inches.

Red Scorpion Fish *Scorpæna russula* Jordan & Bollman

A Pacific coast species represented in our range by the subspecies *S. r. atlanticus*, Nichols & Breder. Known from the Texas coast.

Reaches at least 4 inches in length.

Unarmed Scorpion Fish *Scorpæna inermis* Cuvier & Valenciennes

West Indies north to Florida. Not common.

This species, colored somewhat like the lionfish, is much less ruggose and comparatively spineless, from which condition it derives its name.

Probably does not exceed 6 inches in length.

The Sculpins—*Family Cottidæ*

Chiefly Arctic fishes with large armored heads from which the body tapers rapidly backward. The eyes are placed high. The body is naked or variously armored with bony plates, scales or prickles, but it is never uniformly scaled. The lateral line is present. The dorsal fins are usually separate. The ventral fins are less than I, 5 and thoracic and the pectorals are large and fan-like. They are chiefly bottom fishes, some living at great depths.

A. Spinous dorsal shorter than soft part, of less than 13 spines.

B. No slit behind last gill arch; preopercular spine bifurcate or simple (not multiple or antler-like).

C. Preopercular spine bifurcate; back with a series of plates along each side below base of dorsal fin above lateral line; head naked above; sides with scattered scales; body and head slender; skin above with warty scales and prickles; dorsal IX 18 to 20; anal 14 or 15. *Two-horned Sculpin*, 242.

CC. Preopercular spine simple; strongly hooked upward; back and sides wholly naked; dorsal VII or VIII, 12 to 14; anal 11. *Hook-eared Sculpin*, 242.

BB. A slit behind last gill arch present or absent; preopercular spines 3 or 4, or antler-like (not bifurcate or simple).

D. Bony plates in lateral line 47 to 49 in number, dentate; preopercular spines 4; dorsal XII–25; anal 25. *Mailed Sculpin*, 242.

DD. Lateral line without bony plates.

E. Preopercular spines 3 or 4, not antler-like; slit behind last gill arch present or absent.

F. Preopercule with 3 spines only, the upper 2 straight, the third turned downward.

G. Anal fin very short, 10 or 11 rays, dorsal IX, 13 or 14; upper preopercular spine short, sharp, nearly twice the length of the next; no slit behind last gill arch.

H. Brownish or coppery and white; spinous dorsal highest in middle. *Brassy Sculpin*, 243.

HH. Sharply black and white or livid green; spinous dorsal highest posteriorly. *Mitchill's Sculpin*, 243.

GG. Anal fin of 12 to 14 rays.

I. Upper preopercular spine moderate, about as long as eye and about twice the length of the next spine.

J. Last gill arch without slit or pore; dorsal X, 17; anal 12. *Arctic Sculpin*, 243.

JJ. Last gill arch with a small slit or pore behind it; dorsal X, 17; anal 14. *Greenland Sculpin*, 244.

II. Upper preopercular spine very long, larger than the eye, reaching tip of opercular spine, 4 times the length of second spine; no slit behind last gill arch; dorsal IX, 15; anal 14. *Long-horned Sculpin*, 244.

FF. Preopercle with 4 spines; the fourth turned downward; dorsal VIII or IX, 14 or 15; anal 14 or 15; a slit behind the last gill arch.

EE. Preopercular spine branched, antler-like; slit behind last gill arch small or absent; dorsal XII, 16; anal 18. *Stag-horn Sculpin*, 244.

AA. Spinous dorsal larger than soft part, IV, XII–I, 12; anal 13. *Sea Raven*, 245.

Two-horned Sculpin *Icelus bicornis* (Reinhardt)

Arctic Atlantic, found on the coast of Labrador, in our region, supposed to straggle south to Cape Cod.

A closely related species in the Pacific makes this type of sculpin circumpolar.

Abundant in places. Taken in from 2 to 100 fathoms.

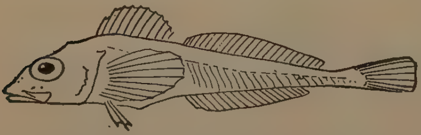
Reaches a length of 6 inches.

Hook-eared Sculpin *Artediellus atlanticus* Jordan & Evermann

Known from Labrador to Cape Cod.

Closely related to the European *A. uncinatus* if the two are not identical.

Not known to exceed 4 inches in length.



Mailed Sculpin

Triglops ommatistius Gilbert

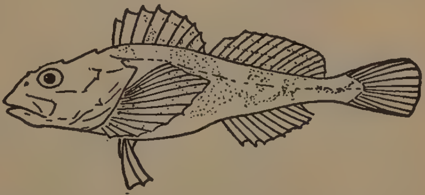
This fish or its closely related species or races is circumpolar in distribution in rather deep water. It reaches south to the Gulf of Maine and possibly to Cape Sable. There are only a few records within the 25 fathom limit.

Probably feeds mostly on small crustaceans, worms, etc.

Apparently spawns in summer. The eggs are heavy, pinkish in color and about 2.0 mm. in diameter.

Does not exceed 8 inches in length.

Brassy Sculpin
Myoxocephalus æneus
(Mitchill)



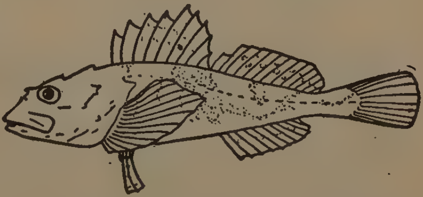
Occurs from New Jersey to southern New England and possibly to the Gulf of St. Lawrence.

Feeds chiefly on worms, small crustaceans, young fish and eel-grass.

Spawns during the winter. The eggs are bluish green and average about 1.6 mm. in diameter.

Reaches a length of 7½ inches.

Mitchill's Sculpin
Myoxcephalus mitchilli
(Cuvier & Valenciennes)



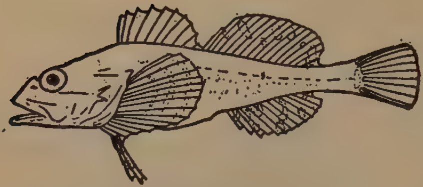
Only known from Long Island waters but is likely often confused with the brassy sculpin, which it closely resembles. (See Key and figures.)

Reaches 6½ inches in length, but is usually 4 or under.

Arctic Sculpin *Myoxocephalus scorpioides* (Fabricius)

Arctic Atlantic, common in the waters between Labrador and Greenland.

Probably does not exceed 1 foot in length.



Greenland Sculpin

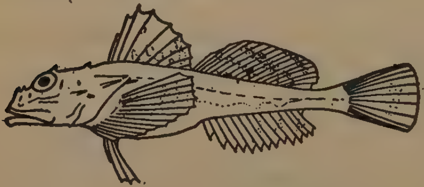
Myoxocephalus scorpius (Linnæus)

Occurs in the Arctic Ocean south to New England and questionably to New York.

Voracious, feeding on practically any organism it is able to engulf.

Spawns from November to January. The eggs are about 1.75 mm. in diameter, adhesive and red in color. They hatch in 4 to 12 weeks dependent on the temperature. Matures in probably the third year.

Reaches a length of about 25 inches.



Long-horned Sculpin

Myoxcephalus octodecimspinosus (Mitchill)

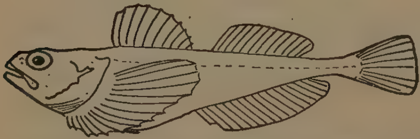
Occurs from Labrador to Virginia.

Practically omnivorous, with fish and crustaceans constituting most of its food.

Spawns in November and December.

Summers in deep water but moves shoreward with the coming of cold weather.

Reaches a length of about 18 inches.



Staghorn Sculpin

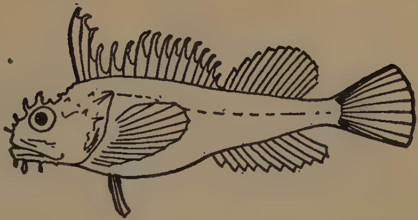
Gymnocanthus tricuspis Reinhardt

Occurs in the north Atlantic south to our coast to Maine.

An arctic species inhabiting the true boreal regions, rare south of Labrador.

Reaches a length of 10 inches.

Sea Raven
Hemitripterus americanus
(Gmelin)



Occurs from Labrador to Chesapeake Bay, but common nly north of Cape Cod.

Feeds largely on invertebrates and to some extent on small ish. Tends to seek deep water during the summer months.

Lacking the elaborate mechanism of the puffers it nevertheless often inflates its belly when handled, somewhat ike a toad.

The sea raven, although usually reddish brown or purplish ot infrequently occurs in a bright yellow (xanthic) phase. Such fish are looked upon by the fisherman with superstition as omens of good luck, bad luck, foul weather, etc., according o the locality.

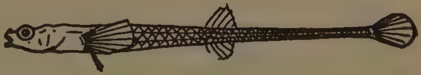
Spawns during the winter. The eggs are about 4.0 mm. n diameter, yellow, becoming amber with development, adhesive and heavy.

Reaches a length of 25 inches and a weight of 5 pounds. Over 15 inches is unusual, however.

The Sea Poachers—*Family Agonidæ*

A peculiar group of long, slim, angulated fishes of fairly deep Arctic waters. They are covered with plates somewhat as are the pipefishes. Only a single species has been recorded rom our range.

Sea Poacher
Aspidophoroides monopteryguis
(Bloch)



Occurs in deep water from Greenland to Cape Cod, accidental south to New York. Probably never normally within the 25 fathom limit.

Reaches a length of about 6 inches.

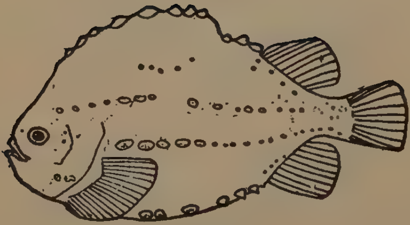
The Lump Suckers—*Family Cyclopteridæ*

Short thick sluggish fishes of the Arctic. They are provided with a sucker formed of the ventral fins which are fused together and are characterized by their exceedingly ruggose "lumpy" outline. They are mostly of dull coloration.

The young of these fishes resemble the sea snails, to which they are closely related.

A. Larger tubercles on body in rows, well separated; spinous dorsal fin becoming obsolete with age. *Lumpfish*, 246.

AA. Larger tubercles on body not in rows, crowded; spinous dorsal fin usually persistent with age. *Spiny Lumpsucker*, 247.



Lumpfish

Cyclopterus lumpus
(Linnæus)

Occurs on both coasts of the Atlantic, on our shore south to New Jersey and rarely to Chesapeake Bay.

Common on rocky coasts, a bottom fish chiefly, but sometimes taken in floating weed.

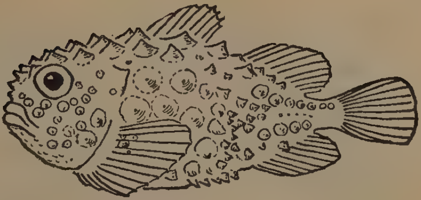
Feeds chiefly on invertebrates, including jellyfish.

Spawns in spring. The eggs are about 2.4 mm. in diameter, heavy and adhesive. They are pink when first laid but change to pale green or yellow with development. The male guards them during incubation and also circulates water about them. A large famale (18 inches) may produce 136,000 eggs. The young fish hide in weed and are then variously mottled but become drab as they grow up and forsake such shelter.

Reaches a length of 23 inches and a weight of 13¼ pounds.

Spiny Lumpsucker

Eumicrotremus spinosus
(Müller)



Occurs in the boreal parts of the Atlantic, occasionally south to the Gulf of Maine.

Probably does not exceed a foot in length.

The Sea Snails—*Family Liparididæ*

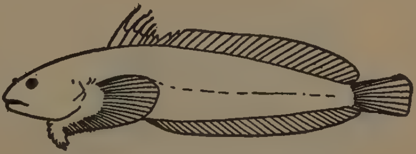
Arctic fishes more or less tadpole-like in form with naked kins. As with the lump suckers the ventral fins are united o form a sucking disk. These and the former family appear o be specialized offshoots of the sculpin-like fishes. Many of he species of this family are found only in very deep water.

A. Dorsal fin divided by a deep notch, which separates the slender spines from the soft rays; dorsal VI, 25; anal 23. *New England Sea-snail*, 247.

AA. Dorsal fin continuous, the spines not separated from the soft rays; dorsal 33 to 35; anal 27 to 29. *North Atlantic Sea-snail*, 247.

New England Sea-snail

Neoliparis atlanticus
Jordan & Evermann

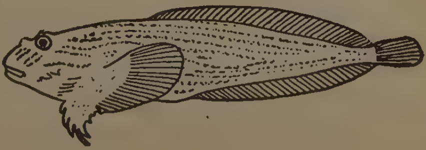


Occurs on rocky shores from Newfoundland to Cape Cod, ometimes straggling to the south side of the Cape.

Reaches a length of 6 inches.

North Atlantic Sea-snail

Liparis liparis
(Linnæus)



Occurs in the north Atlantic on both coasts. Commonest on the European side, north to Spitzbergen. South on our coast to Cape Cod and rarely to Block Island.

Reaches a length of probably not more than 6 inches.

THE SEA ROBINS—*Suborder Craniomi*

Fishes with a suborbital stay similar to that of the Scorpion Fishes but more fully developed and with the pectoral fin either divided into two parts or with free anterior rays.

A. Pectoral fin with its 3 most anterior rays free and bent sharply near their tips. *The Sea Robins*, 248.

AA. Pectoral fin divided to its base into two unequal parts. *The Flying Gurnards*, 252.

The Sea Robins—*Family Triglidæ*

Peculiar big-headed fishes with very large pectoral fins which are preceded by three finger-like rays which are free from the fin. As these fishes rest on the bottom they literally drag themselves along by hooking these rays (which are bent downwards at the tips) in the sand and working them like exploratory fingers.

A. Maxillary less than 3 in length of head, the mandible usually not reaching a vertical from the front of eye; generally a distinct groove across top of head behind eye; black spot on spinous dorsal usually distinct.

B. Depth of body 5; head about 3; interorbital about equal to eye; body and fins nearly plain except for some dark mottlings, chin dark. *Carolina Sea Robin*, 249.

BB. Depth of body about 6; head more than 3; interorbital about 0.4 of eye.

C. Pectoral reaching little past front of anal, not 3 in body, 52 pores in lateral line; body, head and fins covered with round bronzed spots of various sizes. *Slender Sea Robin*, 250.

CC. Pectoral reaching past middle of anal, more than ½ body; 62 pores in lateral line; body not spotted, rose colored; pectorals dusky. *Rosy Sea Robin*, 250.

AA. Maxillary 2 to 2.75 in length of head; the mandible extending backward to under eye or nearly so; no distinct groove across top of head behind eyes; black spot on dorsal diffuse, involving the membranes of more than 2 spines.

D. Preopercular spine without a distinct smaller spine at its base in front.

E. Pectoral fins very long nearly reaching last rays of dorsal.

F. Scales about 75; dorsal X–12; body mottled. *Soldier Sea Robin*, 250.

FF. Scales about 50; dorsal VIII–13; color crimson red. *Crimson Sea Robin*, 250.

EE. Pectoral fins short, not reaching beyond middle of dorsal; dorsal X–12; anal 11; color crimson with darker cloudings and small spots. *Stearn's Sea Robin*, 250.

DD. Preopercular spine with a distinct smaller one at its base; dorsal X–12; anal 11.

G. Cheek bone without a distinct spine at the center of radiation; sides with fine dark horizontal lines. *Striped Sea Robin*, 250.

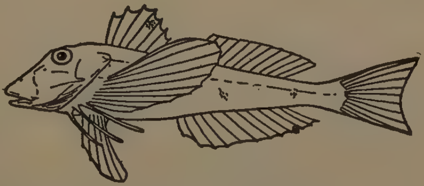
GG. Cheek bone with a distinct spine at its center of radiation.

H. Spines on bones of head moderate, not knife-like; preorbital with a series of serræ and 1 or more bluntish spines.

I. First 3 dorsal spines little, if at all serrate; pectoral with obscure dark spots. *Spotted Sea Robin*, 251.

II. First 3 dorsal spines more or less serrate; pectoral with 2 longitudinal dark areas. *Bean's Sea Robin*, 251.

HH Spines on bones of head elevated, knife-like; 3 or 4 obscure dark cross bands, no lengthwise line. *Southern Sea Robin*, 251.



Carolina Sea Robin
Prionotus carolinus
(Linnæus)

Occurs from the Bay of Fundy to South Carolina, rare north of Cape Cod.

This species is marked by a dark chin.

Moves offshore in winter.

Feeds extensively on small crustaceans and other invertebrates.

Spawns in mid-summer. The eggs are buoyant, non-adhesive, slightly yellowish and average about 1.0 mm. in diameter. They hatch in about 60 hours at a temperature of 58° F.

Reaches a length of 16 inches and a weight of 1¾ pounds.

Slender Sea Robin *Prionotus scitulus*, Jordan

Known from North Carolina to the Gulf Coast of Florida.

A small but common species in its range, not readily confused with others.

Reaches a length of 6 inches.

Rosy Sea Robin *Prionotus roseus*, Jordan & Evermann

Gulf of Mexico in rather deep water.

Probably never occurs normally in water under 25 fathoms. Taken from the stomach of groupers off the Tampa and Pensacola banks.

Reaches a length of over 6 inches.

Soldier Sea Robin *Prionotus miles*, Jenyns

A Pacific coast species represented on our Texas coast of a subspecies *P. m. pectoralis*, Nichols and Breder. Rare.

Known from specimens about 3½ inches long.

Crimson Sea Robin *Prionotus ophryas*, Jordan & Swain

Gulf of Mexico in rather deep water.

Known in a manner similar to the preceding species but not radically devisible.

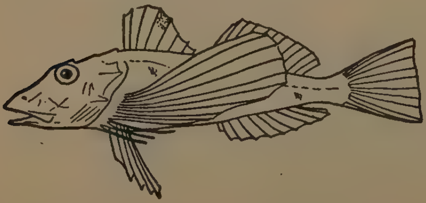
Reaches a length of over 7 inches.

Stearn's Sea Robin *Prionotus stearnsi*, Jordan & Swain

Gulf of Mexico in rather deep water.

This species follows the two preceding ones regarding its occurrence.

Reaches a length of 13 inches.



Striped Sea Robin

Prionotus evolans (Linnæus)

Divisible into 2 races as follows:

A. Pectoral with its rays plain dusky; free rays as well. *P. e. strigatus.*
AA. Pectoral with its rays each crossed by fine black bars, especially distinct near the base of the fin; free rays spotted. *P. e. evolaus.*

The first form is known only from North and South Carolina; from there grading into the second that reaches Cape Cod and, at times, a little beyond.

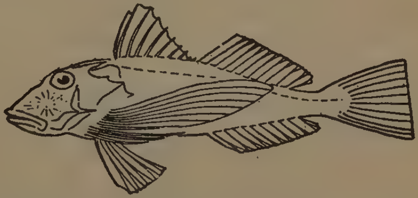
Feeds chiefly on crustaceans and mollusks.

Spawns in summer, in the latitude of New York, at least. The eggs are heavy, non-adhesive, transparent and average about 1.1 mm. in diameter.

The flesh of this fish is palatable, but seldom used, largely from popular prejudice.

Reaches a length of about 1½ feet.

Spotted Sea Robin
Prionotus punctatus (Bloch)



West Indies and coast of South America. Known from the Texas coast. Rare.

Feeds on crustaceans.

Probably does not reach a foot in length.

Bean's Sea Robin *Prionotus beanii* Goode

West Indies north to the Texas coast. Rare.

Probably does not reach a foot in length.

Southern Sea Robin *Prionotus tribulus* (Cuvier)

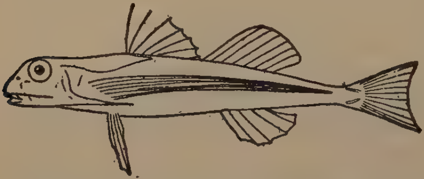
South Atlantic and Gulf Coast, supposed to stray north to Long Island.

This species is very common about Florida.

Reaches a length of about 1 foot.

The Flying Gurnards—*Family Cephalacanthidæ*

A further specialization of the gurnard type in which the pectorals are so enlarged as to permit of short aerial excursions. More remarkable, however, are the ventral fins which can be directed downward and enable the fish to literally walk as though on stilts.



Flying Gurnard
Cephalacanthus volitans
(Linnæus)

Occurs in the warm waters of both coasts of the Atlantic, reaching northward, a few each year, to Massachusetts.

The flying gurnard takes long leaps, volplaning on its huge pectorals. Its flight, however, is in no way to be compared with that of the true flying fishes.

Reaches a length of about 1 foot.

THE GOBIES—*Suborder Gobioidea*

Elongate fishes with large heads, mostly tropical in habits.

A. Ventral fins widely separated; preopercle strongly armed; lateral line present. *The Dragonets*, 252.

AA. Ventral fins close together or united as a sucking disk preopercle with a weak spine or none; no lateral line. *The Gobies*, 253.

The Dragonets—*Family Callionymidæ*

Small fishes of warm seas related to the gobies but superficially resembling the sculpins. Body elongate, naked, head broad and depressed, mouth narrow, the upper jaw distinctly protractile, preopercle armed with a strong spine, lateral line present.

A. Dorsal IV, 8 or 9; anal 8; some of the dorsal spines filamentous; preopercular spine armed with about 9 barbs. *Baird's Dragonet*, 253.

AA. Dorsal IV, 6; anal 4; preopercular spine armed with 2 barbs, the first turned forward. *Spotted Dragonet*, 253.

Baird's Dragonet *Callionymus bairdi*, Jordan

A little known form from the snapper banks between Pensacola and Tampa, Florida.

Reaches at least 4½ inches in length.

Spotted Dragonet *Callionymus calliurus*, Eigenmann & Eigenmann

Known from Key West, Florida.

Rare, taken in 5 fathoms

The Gobies—*Family Gobiidæ*

Small fishes, living for most part on the shores of warm seas. Body naked or scaled, opercle unarmed, preopercle with a short spine or none, no lateral line, ventral fins close together or united to form a sucking disc. Carnivorous fishes.

A. Ventral fins separate, body scaly.
B. Ventral rays I, 4; forehead bluntly rounded; without sharp keel; dorsals separate, VI–22 to 24; caudal lanceolate. *Pensacola Goby*, 255.
BB Ventral rays I, 5; skull without crests.
C. Scales large, 33; body short and elevated. *Sleeper*, 255.
CC. Scales of moderate or small size; 51 to 100; body oblong or elongated.
D. Body moderately robust, the depth 4 to 5.5, scales ctenoid; a small supraoccipital crest.
E. Scales 51, eye 8. *Checkered Goby*, 256.
EE. Scales 57 to 66; eye 5.75 to 8. *Fresh-water Goby*, 256.
DD. Body very slender, elongate, the depth 8 to 9, scales cycloid; no supraoccipital crest, scales 100. *Emerald Goby*, 256.
AA Ventral fins united.
F. Lower jaw broad, not as in the mullets.
G. Dorsal fins separate, free from caudal.
H. Body scaly, in part, at least.
I. Dorsal spines 6.
J. Interorbital area elevated anteriorly, with a large pit-like depression in front of eye; nape with a fleshy crest; scales 26 to 30. *Crested Goby*, 256.

JJ. Interorbital area not elevated anteriorly; no pitlike depression in front of eye; nape without fleshy crest; sometimes a naked strip on back or belly.

K. Upper rays of pectoral silk-like (short, very slender and flexible), free for their entire length; dorsal VI–9 or 10; anal I, 7 to 9; scales 36 to 41. *Mapo*, 256.

KK Upper pectoral rays not silk-like (similar to others).

L. Scales large, 25 to 33.

M. Caudal with 2 spots at its base; lower jaw produced; dorsal VI–10; anal 10; scales 25. *Bridled Goby*, 257.

MM. Caudal plain or with a single spot at its base.

N. Dorsal spines low, the highest little longer than head.

O. Region from nape to dorsal entirely scaled; dorsal VI–12; anal 11 or 12; scales 33. *Spot-tailed Goby*, 257.

OO. Region from nape to dorsal partly or entirely naked.

P. Region between nape and dorsal with a narrow naked median strip; dorsal VI–12; anal 13; scales 33 to 35. *Shufeldt's Goby*, 257.

PP. Region between nape and dorsal entirely naked.

Q. Highest rays of second dorsal little more than ½ head, none reaching base of caudal; dorsal VI–11, anal 10 to 12; scales 25 to 30. *Darting Goby*, 257.

QQ. Highest rays of second dorsal as long as head, the last reaching base of caudal; dorsal VI–11, anal 12; scales 27 to 33. *Branded Goby*, 257.

NN. Dorsal spines high, the highest reaching past middle of second dorsal; nape scaly.

R. Depth 5 to 6; dorsal VI–12; anal 13; scales 27. *Spotted Goby*, 257.

RR. Depth 4⅔; dorsal VI–11; anal 10; scales 27. *Lyre Goby*, 257.

LL. Scales moderate or small, 39 to 90; caudal lanceolate.

S. Body rather deep, the depth about 5; dorsal VI–11; anal 11; scales 39 to 42.

SS. Body elongate, the depth 6.5 to 9, caudal very long.

T. Head 5.5 to 6; scales 60 to 70, patch of scales on opercle obsolete. *Sharp-tailed Goby*, 258.

TT. Head 7 to 8; scales about 90; patch of scales on opercle well developed. *Ocean Goby*, 258.

II. Dorsal spines 7.

U. Scales about 42; dorsal VII–15; anal 16 or 17. *Large-mouthed Goby*, 258.

UU. Scales 45 or over.

V. Dorsal VII–16 or 17; anal 17; eye 3.5; color yellowish or light brown; scales 50.

W. Depth 4.7 to 5.4; mouth moderately oblique; ventral disk reaching a little beyond origin of anal. *Holme's Goby*, 258.

WW. Depth 4.75 to 5; mouth nearly vertical; ventral disk not nearly reaching origin of anal. *Scaled Goby*, 258.

VV. Dorsal VII–16; anal 15; eye 3; color greenish. *Green Goby*, 258.

HH. Body and head entirely naked.

X. Body short; depth 3.9 to 4.8; dorsal VII–12 (rarely 11 or 13); ventral disk reaching ½ way to vent; anal 10 or 11.

Y. Head about 3.4; a black spot at upper edge of operculum. *Texas Goby*, 258.

YY. Head about 3.3; no black spot at upper edge of operculum. *Naked Goby*, 259.

XX. Body more elongate; depth 6 to 7.1; dorsal VII–12 (rarely 11 or 13); anal 11; ventral disk reaching ⅔ way to vent. *Ginsburg's Goby*, 259.

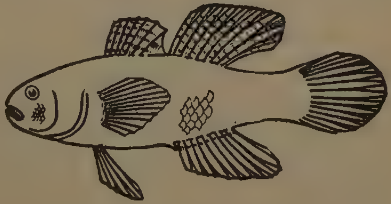
GG. Dorsal fins continuous, the soft part and anal joined to base of caudal, scales minute or wanting; eyes minute; body completely scaled. *Violet Goby*, 259.

FF. Lower jaw tapered and rather pointed, as in the mullets; depth 5.25; teeth in jaws in a single series and moveable. *Mullet Goby*, 259.

Pensacola Goby *Ioglossus calliurus* Bean

A rare goby known only from rather deep water off Pensacola, Florida.

Reaches a length of 4½ inches.



Sleeper
Dormitator maculatus
(Bloch)

A common West Indian species ranging from South Carolina to Brazil.

It inhabits both fresh and salt water and makes a good aquarium fish, being able to live in the most stagnant water.

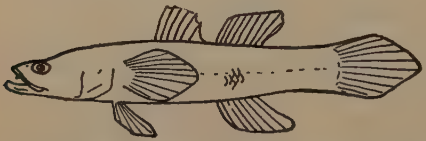
It is a very variable species and reaches sufficient size to be used for food.

Reaches a length of over 1 and possibly 2 feet.

Checkered Goby *Eleotris abacurus* Jordan & Gilbert

A rare form known from a single specimen from Charleston Harbor, South Carolina.

4 inches in length.



Fresh-water Goby

Eleotris pisonis (Gmelin)

West Indian streams from Florida to Brazil. Not a typically marine form, but often taken in brackish water.

Reaches a length of nearly a foot.

Emerald Goby *Erotelis smaragdus* (Cuvier & Valenciennes)

Known from Key West to Cuba.

A beautiful little fish of a deep rich green color usually to be found along coral shores among green algæ which it matches.

Reaches a length of 8 inches.

Crested Goby *Lophogobius cyprinoides* (Pallas)

Known from Florida to the West Indies, usually in streams but often descending to brackish water.

A rather handsome species.

Reaches a length of about 2 inches.

Mapo *Bathygobius soporator* (Cuvier & Valenciennes)

Abundant throughout the West Indies. One of the most abundant shore fish of the tropics. Ranges north to North Carolina.

Usually found in tide pools, under rocks and in similar situations.

Very variable in coloration, but always easily identified by the silk-like upper pectoral rays.

Reaches a length of about 6 inches, although usually smaller.

Bridled Goby *Gobius glaucofrænum* (Gill)

Florida Keys and Tortugas Islands.

A small goby not well known.

Reaches a length of 1½ inches.

Spot-tailed Goby *Gobius stigmaturus* Goode & Bean

Florida Keys.

Not a common species.

Does not reach a large size.

Shufield's Goby *Gobius shufeldti* Jordan & Eigenmann

Gulf coast from fresh waters, but certainly descending to brackish.

Not common nor reaching a large size.

Darting Goby *Gobius boleosoma* Jordan & Gilbert

Pensacola to Key West.

Common in shallow water usually of not more than a foot in depth. Usually found amid ocean debris.

Reaches about 2 inches in length.

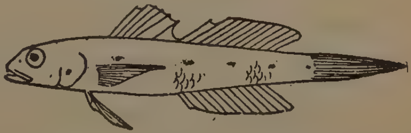
Branded Goby *Gobius encæomus* Jordan & Gilbert

Known from South Carolina to Key West, Florida.

A rare form usually encountered in shallow sandy bays.

Reaches a length of about 2 inches.

Spotted Goby
Gobius stigmaticus
(Poey)



Known from North Carolina to Brazil. Straggles north to Massachusetts.

A very variable and not uncommon species.

Reaches a length of about 5 inches.

Lyre Goby *Gobius lyricus* Girard

Gulf of Mexico from Galveston, Texas, to Cuba.

Fairly common.

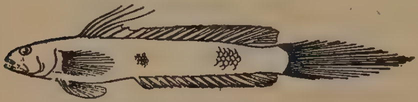
Reaches a length of about 3 inches.

Sharp-tailed Goby *Gobius hastatus* Girard

Known only from Texas.

Possibly a variant of the ocean goby.

Reaches about a foot in length.



Ocean Goby

Gobius oceanicus Pallas

South Carolina to the Gulf coast.

Possibly intergrading with the sharp-tailed goby.

Reaches about a foot in length.

Large-mouthed Goby *Microgobius gulosus* (Girard)

Florida to Texas, north on the east coast to the Indian River.

Not rare and usually found in weedy or sandy places.

Does not reach a large size.

Holme's Goby *Microgobius holmesi* Smith

Known only from Chesapeake Bay and Beaufort, North Carolina.

Feeds on small crustacea.

Nearly ripe specimens have been taken in July in North Carolina.

Reaches a length of about 2 inches.

Scaled Goby *Microgobius eulepis* Eigenmann & Eigenmann

Known from Chesapeake Bay to Beaufort, North Carolina. Rare.

Reaches a length of about 2 inches.

Green Goby *Microgobius thalassinus* Jordan & Gilbert

Known from the coast of South Carolina. Rare.

Reaches a length of about 1½ inches.

Texas Goby *Gobiosoma molestum* Girard

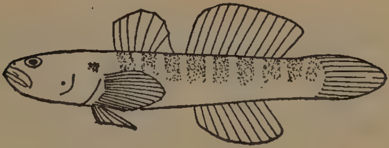
Gulf coast south to Bahia.

Common in shallow water from Key West, Florida, to Texas.

Reaches a length of 2½ inches.

Naked Goby

Gobiosoma bosci
(Lacépède)



Occurs from Cape Cod to Florida.

Frequents grassy bays; common southward.

Feeds chiefly on small crustacea.

Spawns in summer. The eggs are spherical and average about 0.5 mm. in diameter. They are yellow in color, opaque, adhesive and heavier than sea water. As they develop they become elliptical in outline as do most goby eggs. The larvæ on hatching are about 2 mm. long.

Reaches a length of over 2 inches.

Ginsburg's Goby *Gobiosoma ginsburgi* Hildebrand & Schroeder

Known only from Chesapeake Bay.

Feeds chiefly on small crustacea.

Nearly ripe females have been taken in late May.

Found in water as deep as 25 fathoms.

Reaches a length of about 2 inches.

Violet Goby *Gobiodes broussonnetii* Lacépède

West Indies to Brazil, often ascending rivers. Recorded once from New Orleans.

Reaches a length of 20 inches.

Mullet Goby *Mugilostoma gobio* Hildebrand & Schroeder

Known only from Chesapeake Bay and by a single specimen. $1\frac{1}{16}$ inches in length.

The Remoras—*Suborder Discocephali*

Bony fishes with a flat suctorial disk on top of the head which is laminated with transverse septa and is oval in outline.

The Remoras—*Family Echeneididæ*

This remarkable group of fishes is characterized by the ordinal description. The sucking disk enables them to attach firmly to other fishes of a large size and thus affords them free transportation. This sucking disk is of considerable power, but these fish are not parasitic to any greater degree than the small boy that steals a ride on the back of a truck. The disk is believed to be a modified spinous dorsal fin. The larval development is unknown and until such a time when it is we will likely be in the dark concerning the structural origin of this device. These fishes bear certain resemblances to the cobia and it has been suggested that they are related to it instead of the forms here adjacent.

A. Body very slender; ventral fins narrowly adnate to abdomen; lower jaw produced in a flap; pectorals acute, with flexible rays.

B. Laminæ of disk 10. *Louse Fish*, 260.

BB. Laminæ of disk 20 to 28. *Shark Remora*, 260.

AA. Body rather robust; ventral fins broadly adnate to abdomen; lower jaw not produced; pectorals rounded; laminæ of disk 16 to 20.

C. Pectoral rays soft and pliable.

D. Laminæ about 18; soft dorsal with 23 rays. *Off-shore Remora*, 261.

DD Laminæ 14 to 16; soft dorsal with 29 to 32 rays. *Swordfish Remora*, 261.

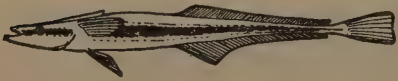
CC. Pectoral rays stiff and ossified; laminæ 18; soft dorsal with 21 to 23 rays. *Spearfish Remora*, 261.

Louse Fish *Phtheirichthys lineatus* (Menzies)

Tropical seas ranging north to South Carolina.

Usually to be found attached to the barracuda, but rare.

Known to reach a length of 16 inches.



Shark Remora

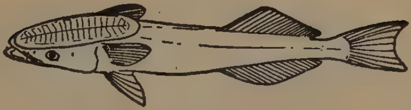
Echeneis naucrates Linnæus

Occurs in warm seas, cosmopolitan, north to Massachusetts Bay.

Usually found attached to the larger shore sharks, tarpon et cetera.

Reaches a length of 38 inches and a weight of 1¾ pounds. Over 2 feet, however, is unusual.

Off-shore Remora
Remora remora
(Linnæus)

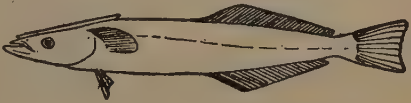


Cosmopolitan in warm seas, casually north to Massachusetts.

More offshore in habit than the shark remora. Also more apt to be found attached to sea turtles than the other species.

Reaches a length of 15 inches.

Swordfish Remora
Remora brachyptera
(Lowe)

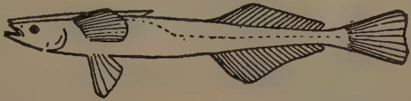


Cosmopolitan in warm seas, rarely north to Maine.

Most frequently taken on swordfish although it has been found in the gill cavity of the ocean sunfish.

Reaches a length of about 1 foot.

Spearfish Remora
Rhombochirus osteochir
(Cuvier)



Occurs in the West Indies, occasionally north to Cape Cod.

Most frequently taken from spearfish.

Reaches a length of about 8½ inches.

THE TRACHINOID FISHES—*Suborder Trachinoidea*

A group of mixed forms rather difficult of definition.

A. Mouth horizontal or nearly so, at least not vertical; eyes lateral.
B. Lateral line complete; caudal fin forked; maxillary not dilated behind. *The Blanquillas*, 262.
BB. Lateral line incomplete, running close to back; caudal rounded; maxillary more or less dilated behind. *The Jawfishes*, 263.
A. Mouth vertical, eyes superior.
C. No electric organs at back of head; lateral line well developed; dorsal spines slender. *The Sand Star-gazers*, 264.

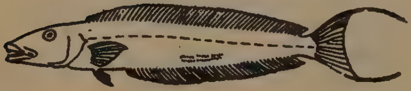
CC. An electric organ at the back of head; lateral line obscure; dorsal spines strong.
The Electric Star-gazers, 264.

The Blanquillos—*Family Malacanthidæ*

Mostly tropical fishes, rather elongate with long low dorsals and anals, or more northern with less elongate bodies and fins and with a fleshy tab on nape. Small ctenoid scales present.

A. Preopercle entire, no fleshy appendage on nape, dorsal and anal with over 40 rays; form elongate.
Sandfish, 262.

AA. Preopercle denticulate, a fleshy appendage on nape dorsal and anal with less than 16 rays, form robust.
Tilefish, 262.



Sandfish

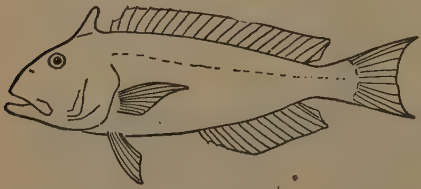
Malacanthus plumeri
(Bloch)

Rather common in the West Indies, reaching southern Florida.

This species inhabits sandy places retreating to rock shelters when danger threatens.

Sometimes used for food.

Reaches a length of nearly 2 feet.



Tilefish

Lopholatilus chamæleonticeps
Goode & Bean

Properly out of the range of this book as it probably never normally occurs in water as shallow as 25 fathoms but is here included because of its unusual interest. It lives only along the outer edge of the continental shelf from off the coast of Maine to the mouth of Chesapeake Bay and possibly a little further south.

This fish was first discovered in 1879 and became the basis of an extensive fishery. In 1882 great numbers of dead tilefish were sighted on the surface, the fishery failed and as late as 1887 not a single live fish could be taken. From then on they began to reappear until at the present time the fishery has been reestablished. The cause of this sudden disappearance has never been determined but it is thought to be due to an abnormal shift in temperature.

Tilefish feed mostly on invertebrates dwelling on the sea bottom and to a lesser extent on open water forms.

Spawning occurs in summer. The eggs are buoyant, nonadhesive and average about 1.35 mm. in diameter.

Reaches a weight of up to 50 pounds but usually does not exceed 35 pounds or 3½ feet in length.

The Jawfishes—*Family Opisthognathidæ*

Large mouthed fishes, with cycloid scales, usually taken in deep water.

A. Maxillary of great length, nearly as long as head, produced behind into a flexible lamina.

B. Scales about 67; dorsal X, 15; anal II, 13; body nearly plain olivaceous, the maxillary not distinctly striped on its inner surface. *Long-tailed Jawfish*, 263.

BB. Scales about 100; dorsal XI, 17; anal II, 16; body and fins much variegated, the maxillary with two bold black stripes on a white ground on its inner surface. *Large-mouthed Jawfish*, 264.

AA. Maxillary normal, truncate behind, much shorter than head.

C. Dorsal fin with a conspicuous dusky blotch in front; scales about 65; dorsal rays 15. *Florida Jawfish*, 264.

CC. Dorsal fin nearly plain, as is rest of body and fins, scales about 100; dorsal rays 24. *Pensacola Jawfish*, 264.

Long-tailed Jawfish *Opisthognathus lonchurum* Jordan & Gilbert

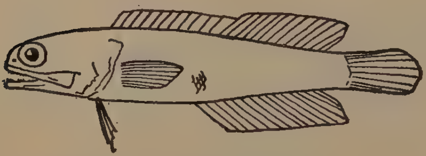
Gulf of Mexico in deep water. Known from 2 specimens from the Pensacola snapper banks.

Little is known of this species.

Large-mouthed Jawfish *Opisthognathus macrognathum* Poey

Known from the Florida Keys and Cuba.

A little known species.



Florida Jawfish

Gnathypops maxillosa (Poey)

Known from Florida and Cuba.

A little known species.

Pensacola Jawfish *Gnathypops mystacina* Jordan

Gulf of Mexico in deep water. Known from the Pensacola snapper banks.

Reaches a length of at least 3½ inches.

The Sand Star-gazers—*Family Dactyloscopidæ*

A small group represented in our region by a single species. Closely related to the electric star-gazers which appear to be a further specialization. It differs from it by having a well developed lateral line and slender dorsal spines. The ventral rays are I, 3.

Sand Star-gazer *Dactyloscopus tridigitatus* Gill

West Indies, north to southern Florida. Rather common on sandy bottoms about the Florida Keys.

Does not reach a large size.

The Electric Star-gazers—*Family Uranoscopidæ*

Fishes of sandy bottoms with small superior eyes. The mouth is vertical and large. The lateral line is obscure and the dorsal spines are strong and pungent. There are electric organs at the back of the head which have been developed from specializations of the optic nerve.

A. Naked space between forks of the "Y" on top of head long and narrow, but shorter than the vertical limb of the "Y". *Southern Star-gazer*, 265.

AA. Naked space between forks of the "Y" short and broad, but longer than the very short vertical limb of the "Y". *Northern Star-gazer*, 265.

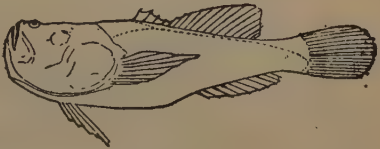
Southern Star-gazer *Astroscopus y-græcum* (Cuvier & Valenciennes)

West Indies, north to Cape Hatteras.

This species so far as known is similar in habits to the next and indeed may be identical to it as both are subject to much variation.

Reaches a length of about 15 inches.

Northern Star-gazer
Astroscopus guttatus (Abbott)



Known from New York to Virginia.

Feeds chiefly on small crustaceans and fishes. It is not known whether the electric power of these fishes is used to stun the prey or for defense alone. Specimens as small as 6 inches are capable of giving a perceptible shock. They often remain buried in the sand for long periods with only their upturned eyes and nostrils protruding.

Little is known of their habits of reproduction.

Reaches a length of a little over 12 inches.

THE TOADFISHES—*Suborder Haplodoci*

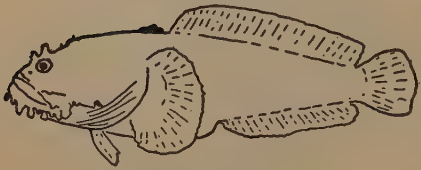
An easily recognized group of one family.

The Toadfishes—*Family Batrachoididæ*

Depressed bottom fishes with no scales. First dorsal of a few small spines, often buried in thick skin.

A. Dorsal spines 3; opercle developed as 2 strong diverging spines; subopercle rather strong with 2 spines, similar to those of opercle; pectoral axil with a large foramen. *Toadfish*, 266.

AA. Dorsal spines 2; opercle very small, its posterior part feebly developed as a single strong spine; subopercle feebly developed, narrowed and not ending in a spine; pectoral axil without a foramen.
Midshipman, 266.



Toadfish
Opsanus tau
(Linnæus)

Occurs from Maine to Cuba. Most common from Cape Cod to Cape Hatteras.

Found in shallow water hiding among weeds and rubbish. Hibernates in mud during winter. It is naturally sluggish in habits. Feeds largely on crustaceans, small fishes and mollusks.

The toadfish spawns in June and July. The eggs are heavy and adhesive and average about 5.0 mm. in diameter. One or both parents guard the eggs, which are generally placed in a crevice, old tin can, shoe or similar cavity. It is the only case of which we know where a marine fish has taken to nesting cavities unintentionally provided by man. The eggs hatch in from 10 to 26 days dependent on temperature. The toadfish is very pugnacious and capable of inflicting a savage bite, especially when guarding the eggs.

Reaches a length of 15 inches although a length of a foot is exceptional.

Midshipman *Porichthys porosissimus* (Cuvier & Valenciennes)

Known from South Carolina to Texas and Argentina. Fairly common about Galveston.

These fish make a curious sound when captured, by vibrating their air-bladder. It has earned for them in some localities the name "singing fish."

There are various lines of dark outlined pores on the body and head which are suggested by the specific name.

Reaches a length of 8 inches.

The Cling Fishes—*Suborder Xenopterygii*

A well marked group of small fishes of one family.

The Cling Fishes—*Family Gobeisocidæ*

Small tadpole shaped depressed fishes with a naked skin and a large ventral sucking disk. They are usually dark colored, frequently plain black or nearly so. Although there have been numerous species described from the West Indies it is believed that but one is found in our range proper. Others, however, may be expected and should be looked for.

Cling Fish *Gobiesox strumosus* Cope

Known from Chesapeake Bay to the Gulf of Mexico and probably beyond.

Feeds chiefly on small crustaceans.

A sluggish fish clinging for most part to submerged objects, such as piles, shells or rocks by means of its large ventral sucking disk.

Reaches a length of about 4 inches.

The Blennioid Fishes—*Suborder Blenniodea*

A group of slim bodied fishes in which the ventrals have a reduced number of rays.

A. Teeth not developed as coarse molars.
B. Mouth not vertical. *The Blennies*, 267.
BB. Mouth nearly vertical; no lateral line; no ventral fins; teeth strong. *The Wry-mouths*, 275.
AA. Teeth developed as coarse molars on vomer, palatines and sides of lower jaw; no lateral line; no ventral fins. *The Wolffishes* 275.

The Blennies—*Family Blenniidæ*

Usually small tropical or arctic fish with or without small scales, either cycloid or ctenoid. The ventral fins have 1 spine and 1 to 3 soft rays, never more. There are many species, and many are difficult of differentiation.

A. Tropical Blennies.

B. Body scaly (cycloid); lateral line present, arched over pectoral, becoming median posteriorly, or obsolete; species oviviparous.

C. Dorsal XVIII, 12; scales 70; series of hair-like filaments on each side of head; a tentacle over eye; depth 3½. *Hairy Blenny*, 270.

D. First 3 spines of dorsal forming a separate fin, being much higher than the rest of fin; snout rather acute; dorsal III–XXII, 1; dorsal with 2 ocelli; anal with 1. *Marbled Blenny*, 270.

DD. First 3 spines of dorsal scarcely forming a separate fin; not higher than rest; snout not very acute; anal without ocellus.

E. Caudal fin pale, usually with a dark bar at its base; a notch between third and fourth dorsal spines.

F. Dorsal III–XXVII; scales 34 to 36; dorsal and anal plain dusky. *Brown Blenny*, 270.

FF. Dorsal III–XXIV, 1, scales 38; dorsal with I ocellus. *Banded Blenny*, 271.

EE. Caudal fin black, body chiefly black; head mottled with whitish; no notch between third and fourth dorsal spines; dorsal III–XXVII, 1; dorsal with 2 ocelli. *Black Blenny*, 271.

BB. Body scaleless; species oviparous.

G. Teeth comb-like, in a single row in each jaw, behind which are sometimes long canines; vomer and palatines usually toothless; lateral line usually single.

H. Teeth slender, all fixed, attached to base of jaws and not movable; caudal fin rounded.

I. Gill membranes free from isthmus, or at least forming a distinct fold across it, one or both jaws with posterior fang-like canines much longer than anterior teeth, a supraorbital cirrus present; profile of snout rather blunt.

J. Canines strong, present in both jaws; no nuchal cirri.

K. Dorsal rays XI or XII, 17 or 18.

L. Supraorbital cirrus bifid; dorsal free from caudal.

M. Supraorbital cirrus as long as head; dorsal emarginate; sides spotted; dorsal XI, 17. *Seaweed Blenny*, 271.

MM. Supraorbital cirrus as long as eye and snout; dorsal continuous; color olivaceous with dark bars; dorsal XII, 18. *Stearn's Blenny*, 271.

LL. Supraorbital cirrus bifid, nearly as long as head; last ray of dorsal joined to caudal; sides with a network of blue lines; dorsal XII, 18. *Honeycombed Blenny*, 271.

KK. Dorsal rays XII, 21 or 22; supraorbital cirrus long, fringed; dorsal free from caudal; cheeks with network of lines, body nearly plain. *Horned Blenny*, 271.

JJ. Canines short and stoutish, present in lower jaw only; nape with a comb of many close-set cirri on a fleshy crest; dorsal fin continuous, free from caudal; dorsal XII, 16 or 17. *Molly Miller*, 271.

II. Gill membranes broadly united to the isthmus, the gill openings restricted to the sides.

N. One or both jaws with posterior fang-like canines; dorsal XI, 15 to XIII, 14. *Crested Blenny*, 272.

NN. Jaws without posterior canines, the teeth equal.

O. Mouth small, the maxillary extending scarcely beyond front of eye, the head decurved in profile.

P. Orbital cirrus simple, large or small. *Freckled Blenny*, 272.

PP. Orbital cirrus forked at tip, long in males. *Carolina Blenny*, 272.

OO. Mouth large, the maxillary extending to beyond the middle of eye; the head rather pointed in profile; dorsal joined to base of caudal.

Q. Maxillary not reaching to beyond eye.

R. Maxillary not reaching posterior border of eye, 2⅓ in head. *Florida Blenny*, 272.

RR. Maxillary reaching posterior border of eye. *Lined Blenny*, 272.

QQ. Maxillary reaching beyond eye. *Striped Blenny*, 272.

HH. Teeth of front of jaws all movable, implanted in skin of lips.

S. Vomer toothless; one or both jaws with posterior canines; dorsal fin continuous; dorsal XII, 21 on XIII, 20. *Rock Skipper*, 273.

SS. Vomer with a few teeth; posterior canines small; dorsal XII, 16. *West Indian Blenny*, 273.

GG. Teeth unequal, not comb-like; no lateral line; no cirri; teeth on palatines, dorsal continuous, spines and rays not distinct, 35; jaws long and sharp. *Banner Blenny*, 273.

AA. Artic and Subarctic Blennies.

T. Gill openings not continued forward below, the membranes broadly united, ventral fins small; scales small cycloid or wanting; pectorals small or wanting.

U. Body scaleless, ventrals moderate; anal apines 2; no lateral line; no pseudoborchiæ; dorsal LI. *Hemphill's Blenny*, 273.

UU. Body covered with small cycloid scales; ventral fins a small spine and a small ray; caudal well developed; dorsal LXXVI to LXXXV; depth 7 to 8. *Rock Eel*, 273.

TT. Gill openings continued forward below, the membranes separate or nearly so, scarcely joined to isthmus; pectorals and ventrals well developed.

V. Lateral line obsolete; body very elongate.

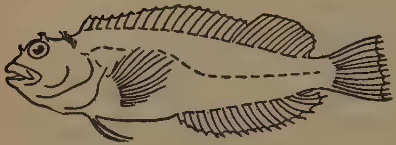
W. Pectorals with upper and middle rays shorter than lower, teeth on vomer and palatines. *Shanny*, 274.

WW. Pectorals with middle rays longest.

X. Teeth on palatines more or less developed, at least in adult; dorsal spines 63; anal rays 43. *Greenland Blenny*, 274.

XX. No palatine teeth; dorsal spines 72 to 75; anal rays about 50. *Snake Blenny*, 274.

VV. Lateral line present, double or dividing into 2 on each side; teeth in jaws, vomer and palatines; dorsal XLIV. *Ulva-fish*, 274.



Hairy Blenny
Labrisomus nuchipinnis
(Quoy & Gaimad)

Known from the Florida Keys to Brazil.
Generally common, especially in tide pools.
Reaches a length of 8 inches.

Marbled Blenny *Auchenopterus marmoratus* (Steindachner)

Florida Keys and Cuba.
Inhabits beds of eel-grass chiefly.
Reaches a length of about 3 inches.

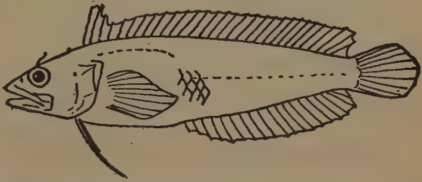
Brown Blenny *Auchenopterus affinis* (Steindachner)

West Indies north to the Florida Keys.

Banded Blenny *Auchenopterus fasciatus* (Steindachner)

Florida Keys.
Reaches a length of about 2 inches.

Black Blenny
Auchenopterus nox
(Jordan & Gilbert)



Known from a single specimen from Key West.

This and the three preceding species are closely related and their status is uncertain.

Seaweed Blenny *Blennius fucorum* Cuvier & Valenciennes

Recorded from the open sea in floating seaweed off New York and Chesapeake Bay.
Reaches a length of about 2 inches.

Stearns Blenny *Blennius stearnsi* Jordan & Gilbert

Gulf of Mexico in deep water. Taken from the stomachs of red snappers of Pensacola.
Reaches at least 3 inches in length.

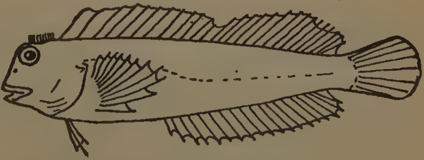
Honey-combed Blenny *Blennius favosus* Goode & Bean

Known from Garden Key, Florida.
Reaches at least 3 inches in length.

Horned Blenny *Blennius pilicornis* Cuvier & Valenciennes

Known from Florida to Brazil.
Reaches a length of 6 inches.

Molly Miller
Blennius cristatus
Linnæus



Known from Florida to Brazil.
Reaches a length of 4 inches.

Crested Blenny *Hypleurochilus geminatus* (Wood)

South Atlantic and Gulf states.

In this species the sexes are dissimilar, the males having a high supraorbital crest which the females lack.

Reaches a length of nearly 3 inches.

Freckled Blenny *Hypsoblennius ianthus* (Jordan & Gilbert)

Known from South Carolina to Texas.

Fairly common, especially in rock pools.

Reaches a length of about 2½ inches.

Carolina Blenny *Hypsoblennius hentz* (Le Sueur)

Known from Chesapeake Bay to Florida.

Feeds chiefly on small crustaceans, mollusks, etc.

Spawns in summer.

Reaches a length of about 4 inches.

Florida Blenny *Chasmodes saburræ* Jordan & Gilbert

Pensacola Bay, Florida. Fairly common in shallow water.

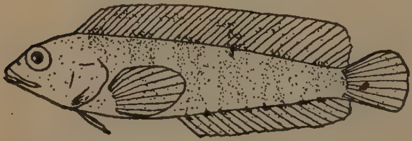
Reaches a length of about 4 inches.

Lined Blenny *Chasmodes novemlineatus* (Wood)

Known from Florida to South Carolina.

Locally abundant.

Reaches a length of 2 inches.



Striped Blenny *Chasmodes bosquianus* (Lacépède)

Occurs from Florida to New York. Rare north of Maryland.

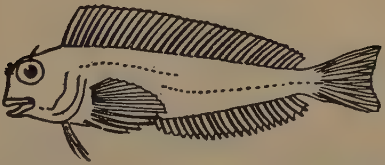
Common in shallow water, the young difficult to see on account of coloration and pattern when hiding under weed.

Feeds chiefly on small crustaceans and mollusks. Spawns from April to August. The eggs are heavy and adhesive and are usually found in rock crevices, empty oyster shells and similar places of concealment.

Reaches a length of about 5 inches.

Rock Skipper

Rupiscartes atlanticus (Cuvier & Valenciennes)



Tropical America north to southern Florida.

Found about rocky places.

Reaches a length of 8 inches.

West Indian Blenny *Salariichthys textilis* (Quoy & Gaimard)

Known from Brazil, West Indies, southern Florida, north to Bermuda.

Reaches a length of about 4 inches.

Banner Blenny *Emblemaria atlantica* Jordan & Evermann

Known from a single specimen from the stomach of a Grouper off Pensacola, Florida.

3½ inches in length.

Hemphill's Blenny *Stathmonotus hemphillii* Bean

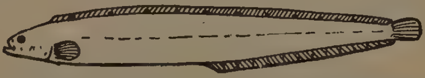
Known from Key West, Florida.

Reaches a length of 2 inches.

Another little known form, *S. tekla* Nichols which differs from *S. Hemphillii* in the possession of scales and may be *Auchenistius stahli*, Evermann & Marsh described from Porto Rico, is recorded from Florida. Dorsal XL, anal II, 23.

Rock Eel

Pholis gunellus (Linnæus)



Occurs on both Atlantic coasts, south to Massachusetts and rarely New Jersey.

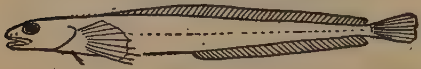
Found along shore hiding in rock crevices.

Spawns during the colder months. The eggs are about 2.0 mm. in diameter, opaque whitish, heavy and adhesive. They hatch in 6 to 10 weeks, depending upon temperature. It apparently curls about its eggs during incubation. They are laid in a cluster in rock crevices, empty shells, etc.

Feeds largely on worms, small crustaceans and mollusks.

The coloration is extremely variable, varying from olivaceous to bright red.

Reaches a length of 12 inches.



Shanny

Leptoclinus maculatus Fries

An arctic species reaching southward to Maine in deep water.

Feeds largely on small pelagic crustaceans and worms.

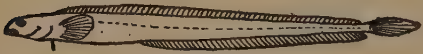
Supposed to spawn in winter.

Reaches a length of about 7 inches.

Greenland Blenny *Lumpenus fabricii* (Cuvier & Valenciennes)

Arctic seas, south to the Gulf of St. Lawrence.

Does not reach a large size.



Snake Blenny

Lumpenus lampetræformis Walbaum

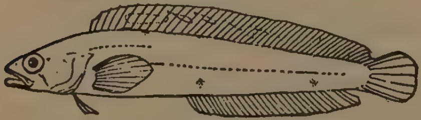
Occurs in the Arctic and north Atlantic Oceans south to Massachusetts on our coast.

Found near our offshore limit of 25 fathoms and is supposed to burrow in mud or clay bottoms.

Feeds largely on small invertebrates.

Supposed to spawn in autumn.

Reaches a length of 16 inches.



Ulva-fish

Ulvaria subbifurcata (Storer)

Occurs in the north Atlantic south to Cape Cod, very rare on the south side of the Cape.

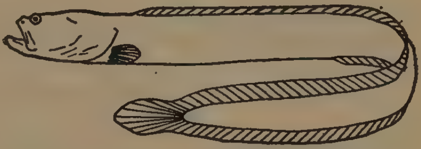
Found among seaweed and under stones from low tide to at least 30 fathoms.

Reaches at least 6 inches in length.

The Wry-mouths—*Family Cryptocanthodidæ*

Elongate, slender, naked fishes with no lateral line. The gill openings are prolonged forward below. Eyes small and placed high. Dorsal and anal joined to caudal. Northern fishes.

Wry-mouth
Cryptocanthodes maculatus
(Storer)



Occurs from Labrador to New York. Rare south of Cape Cod.

Feeds largely on crustaceans, mollusks and fishes. A bottom fish often inhabiting extensively branched burrows in mud flats.

Spawns in winter.

Usually light brown in color, variously spotted. A pale immaculate form usually called "ghost-fish" has been supposed to be an albinistic phase.

Reaches a length of about 3 feet.

The Wolf-fishes—*Family Anarhichodidæ*

Large mouthed voracious fishes with a most formidable molar dentition. The gill membranes are broadly united to the isthmus. The dorsal fin is high and composed entirely of flexible spines. There are no ventral fins and the pectorals are broad and placed low. Occurs only in the northern part of our range.

A. Vomerine teeth not reaching further backward than the palatine teeth.

B. Back and sides vaguely mottled, without distinct spots or bands; vomerine teeth not extending nearly as far back as the palatine teeth. *Northern Wolf-fish*, 276.

BB. Back and sides profusely covered with roundish black spots; vomerine teeth extending nearly as far back as the palatine teeth. *Spotted Wolf-fish*, 276.

AA. Vomerine teeth extending much further back than the short band of palatine teeth; sides of body with 9 to 12 dark cross bars; nape and shoulder with dark spots. *Common Wolf-fish*, 276.

Northern Wolf-fish *Anarhichas latifrons* Steenstrup & Hallgrimsson

Known mostly from north of the Arctic Circle, south on the American coast to Banquereau. Once recorded from off Canso, Nova Scotia, but in 50 fathoms.

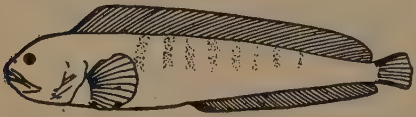
The teeth are much smaller than in the common wolf-fish.

Spotted Wolf-fish *Anarhichas minor* Olafsen

Occurs mostly within the Arctic Circle but extends southward to Maine on our coast.

Its diet is similar to the common wolf-fish, so far as known, but it tends to keep to deeper water, having been taken in up to 240 fathoms.

Said to reach a length of about 6 feet.



Common Wolf-fish
Anarhichas lupus Linnæus

Occurs on both shores of the north Atlantic south to Cape Cod and rarely to New Jersey on our coast.

An extremely hard mouthed vicious fish feeding on hard-shelled mollusks, crustaceans and echinoderms. A solitary species, that is dangerous to handle when caught.

Spawns in winter. The eggs are yellowish, opaque, adhesive and average about 5.8 mm. in diameter.

Reaches a length of 5 feet and a weight of 30 pounds.

THE EEL-POUTS—*Suborder Ophidioidea*

A group similar to the blennioid fishes except that no spines are ever developed in any fins except the dorsal.

A. Pseudobranchiæ well developed.

B. Ventral fins jugular, inserted well behind eye; gill membranes united to isthmus. *The Eel-pouts*, 277.

BB. Ventral fins developed as slender filaments attached at throat not far behind eye; gill membranes free from isthmus. *The Cusk-eels*, 278.

AA. Pseudobranchiæ absent or rudimentary.

C. Ventral fins absent; vent at throat. *The Pearl-fishes*, 279.

CC. Ventral fins well developed; vent posterior, normal. *The Brotulid Fishes*, 280.

The Eel-pouts—*Family Zoarcidæ*

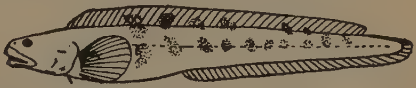
Mostly elongate, arctic, deep water fishes, two of which reach our range. Dorsal and anal elongate and with soft flexible rays. Pectorals large and rounded, ventrals very small, at throat. The lower jaw is included.

A. Dorsal fin not continuous with caudal. *Shore Eel-pout*, 277.

AA. Dorsal fin continuous with caudal. *Reticulated Eel-pout*, 277.

Shore Eel-pout

Zoarces anguillaris (Peck)



Occurs from Labrador to Delaware.

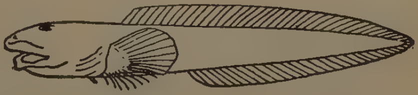
Feeds on mollusks, crustaceans and to a less extent on fishes.

Apparently spawns in autumn. The breeding habits are not known but a closely related European form brings forth living young. The shore eel-pout is supposed not to reach maturity before the eighth year. It tends to keep offshore in summer.

Said to reach a length of 3½ feet and a weight of 12 pounds. Over 2½ feet is unusual however.

Reticulated Eel-pout

Lycodes reticulatus Reinhardt



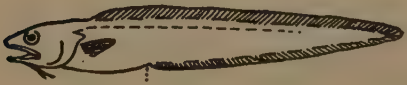
Occurs on both shores of the Atlantic. South on our coast to Rhode Island.

Reaches a length of about 22 inches.

The Cusk Eels—*Family Ophidiidæ*

Elongate, more or less eel-shaped fishes with very small scales which are placed in small non-imbricated series at right angles to one another. The ventral fins are reduced to a bifurcate barble at the throat. The vertical fins are low and spineless and confluent about the tail. Mostly fishes of warm seas and usually in deep water.

A. Head scaly, at least above; snout with a decurved hook at tip; gill-rakers 4. *Short-bearded Cusk Eel*, 278.
AA. Head scaleless.
B. Air bladder olbong-ovate, not contracted behind and without a posterior foramen.
C. Head 4.66; vertical fins not dark edges. *Bean's Cusk Eel*, 278.
CC. Head 6.0; vertical fins dark edged. *Holbrook's Cusk Eel*, 279.
BB. Air bladder short, thick reniform or orbicular, with a large foramen behind.
D. Opercle ending in a flat point without a spine. *Slippery Dick*, 279.
DD. Opercle ending in a spine concealed in the skin.
E. Sides blotched; maxillary 1.8. *Spotted Cusk Eel*, 279.
EE. Sides striped; maxillary 2.3. *Welsh's Cusk Eel*, 279.



Short-bearded Cusk Eel

Lepophidium brevibarbe (Cuvier)

West Indies and Brazil, known on our range from off the Texas coast.

Reaches at least 8 inches in length.

Bean's Cusk Eel *Ophidion beani* Jordan & Gilbert

A little known form from the Gulf of Mexico. Taken from the snapper banks of Pensacola and probably rarely entering our range.

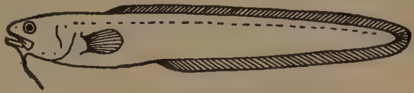
Reaches at least 4 inches.

Holbrook's Cusk Eel *Ophidion holbrooki* (Putnam)

A rare form recorded from Key West, Florida and the Gulf of Mexico.

Reaches at least 6 inches.

Slippery Dick
Rissola marginata
(DeKay)



Occurs from New York to Texas.

Frequents sandy shores, burrowing in the sand, but apparently nowhere common.

Reaches a length of about 6 inches.

Spotted Cusk Eel *Otophidium omastimum* (Jordan & Gilbert)

A rare form from the snapper banks off Pensacola. Probably occurs only rarely, if ever, within our limits.

Reaches a length of at least 3½ inches.

Welsh's Cusk Eel *Otophidium welshi* Nichols & Breder

A rare form from the coast of Texas.

Reaches at least 7½ inches in length.

The Pearl Fishes—*Family Fierasferidæ*

Small elongate, scaleless, tropical fishes. There are no barbles, the lower jaw is included, the vent is at the throat and the gill membranes are somewhat united but free from the isthmus. The vertical fins are very low and are confluent. They lack spines. A single definite species occurs within our range.

Pearl Fish *Fierasfer affinis* (Günther)

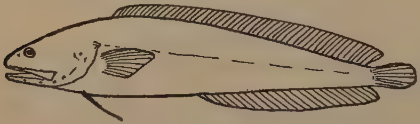
Florida Keys and the West Indies.

These fishes live usually within the shells of mollusks or the cavities of sea cucumbers (holothurians). They seek the protection offered by these living animals, feeding on small organisms quite independently of them, not being either parasites or commensals.

They reach a length of a little over 4 inches.

The Brotulid Fishes—*Family Brotulidæ*

Mostly deep sea fishes with elongate gradually tapering bodies which are covered with minute cycloid scales. The gill openings are very large and the membranes are mostly free from the isthmus. A single species occurs in our range, although many more are to be found in the deeper water just off our seaward limit.



Brotula

Ogilbia cayorum Evermann & Kendall

A rare form recorded from the Florida Keys. Probably a stray from deeper waters.

Known to reach a length of 2.33 inches.

THE JUGULAR FISHES—*Suborder Anacanthini*

A large group of oceanic fishes with no spines in the fins, mostly northern and deep sea in distribution.

A. Caudal fin present; body not tapering to a point behind.

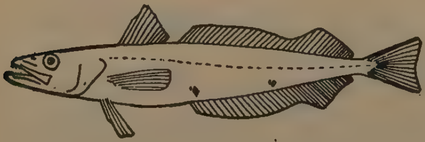
B. Scales large; no barbels. *The Hakes*, 280.

BB. Scales minute; usually a barbel on the chin. *The Codfishes*, 281.

AA. Caudal fin absent; body tapering to a point behind. *The Grenadiers*, 286.

The Hakes—*Family Merlucciidæ*

Cod-like fishes with smooth deciduous scales, 2 dorsal fins and a single anal. One species is found in our range.



Silver Hake

Merluccius bilinearis (Mitchill)

LaMonte, Pl. 39

Occurs from the Grand Banks to New York and in deep water to the Bahamas. Most common between Cape Cod and Cape Sable.

A voracious fish feeding largely on smaller fishes, small crustaceans, etc.

Spawns in water of moderate depth in midsummer. The eggs are buoyant, non-adhesive, transparent and average about 0.9 mm. in diameter. They hatch in about 48 hours at a temperature of 72° F.

Usually found over sandy or pebbly bottoms. The vertical range is from the surface to 300 fathoms.

Reaches a length of nearly 2 feet.

The Codfishes—*Family Gadidæ*

Mostly cold water fishes, with fine scales and spineless fins. There are either three dorsal fins and two anals or two dorsals, the first very short and the second long, and a single long anal. In the latter case the ventrals are produced into long rays, two or three to a side. A few have a single dorsal and "normal" ventrals. Numerous representatives are deep water fishes.

A. Anal fins 2; dorsal fins 3; ventrals not produced into 2 long filaments each.

B. Lower jaw projecting; caudal concave; barbel on chin minute. *Pollack*, 282.

BB. Lower jaw included; caudal not concave; barbel on chin well developed.

C. Mouth large; lateral line pale.

D. Vent in front of second dorsal; ventral fin narrow, with a long filament on the anterior edge. *Tomcod*, 282.

DD. Vent below second dorsal; ventral fin with only a short filament. *Cod*, 283.

CC. Mouth small; lateral line black. *Haddock*, 284.

AA. Anal fin single; dorsal fins usually 2, the second one long, or at least not 3 distinct fins.

E. Dorsal fins 2, the first short and the second long.

F. First dorsal composed of distinct rays similar to those of the second; ventral fins each of 2 or 3 slender rays.

G. First dorsal fin not high, none of its rays filamentous.

H. Scales moderate, 90 to 95; dorsal 8–43; anal 45; sides with pale spots. *Spotted Ling*, 284.

HH. Scales small, 120 to 155.

I. Dorsal 13–57; anal 50; scales 120. *Florida Ling*, 285.

II. Dorsal 10–62; anal 53; scales 155. *Earl's Ling*, 285.

GG. First dorsal fin high, 1 or more of its rays filamentous.

J. Dorsal 9–57; anal 48; scales 140; ventrals reaching vent. *Boston Ling*, 285.

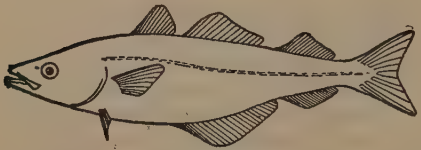
JJ. Dorsal 9–57; anal 50; scales 110; ventrals reaching beyond vent. *Squirrel Ling*, 285.

FF. First dorsal composed of a single slender ray followed by a band of fringes; ventrals each of 5 to 7 rays.

K. Barbels 3; snout with 2, 1 at each nostril, none at tip, chin with 1. *Silvery Rockling*, 286.

KK. Barbels 4, snout with 3, 1 at tip and 1 at each nostril, chin with 1. *Four-bearded Rockling*, 286.

EE. Dorsal fin single, long and low; ventral fins with several rays. *Cusk*, 286.



Pollack

Pollachius virens
(Linnæus)
LaMonte, Pl. 40

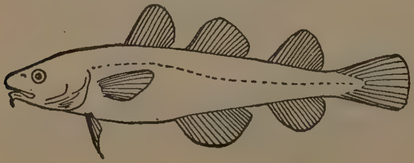
Occurs in the north Atlantic on both coasts south to Cape Cod normally, rarely to New York and occasionally to Chesapeake Bay.

Feeds largely on fishes and to a certain extent on small crustaceans.

Spawns from October to December at depths of from 15 to 50 fathoms. The eggs are non-adhesive, buoyant and average about 1.2 mm. in diameter. The usual number produced by a female is about 200,000 but the maximum is over 400,000. They hatch in about 9 days at a temperature of 43° F. They apparently mature in 3 years.

The pollack is more active than either the cod or haddock and tends to swim nearer the surface than either although it may be found at almost any level between the surface and the bottom.

The average adult is about 4 pounds. The record is 35 pounds with a length of 3½ feet.



Tomcod

Microgadus tomcod
(Walbaum)
LaMonte, Pl. 40

Occurs from Labrador to Virginia.

Feeds largely on small invertebrates and to some extent on fishes.

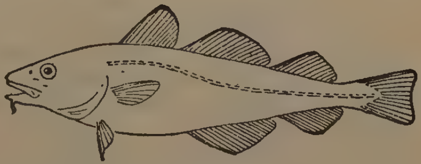
Spawns from November to February near shore or in streams that are practically fresh. The eggs are heavy, non-adhesive and average 1.7 mm. in diameter. The average number a female deposits is about 25,000 and the maximum is nearly 44,000. They hatch in about 35 days at a temperature of 40° F.

In the southern part of their range tomcod move offshore in the warmer weather seeking colder and deeper water.

Seldom exceeds a length of a foot but records reach up to 15 inches and 1¼ pounds.

Cod

Gadus callarias
Linnæus
LaMonte, Pl. 39



Occurs on both coasts of the Atlantic south on our shores to Virginia but not common south of New York.

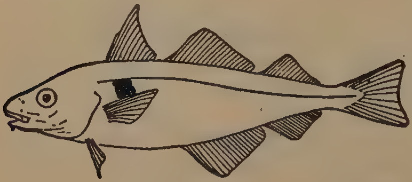
Feeds on mollusks, worms, crustaceans, fishes and nearly anything available that they come across as they travel in hungry packs over the sea bottom.

Codfish spawn from October to April. The eggs are buoyant, non-adhesive and average about 1.6 mm. in diameter. They hatch in about 17 days at a temperature of 40° F. A female about 3 feet long may produce over 2,700,000 eggs whereas records of large fish (70 pounds) may produce over 9,000,000 in a season. The eggs are not all released at one time and it is probable there is no distinct pairing, the spawning probably being engaged in by the school as a unit.

The cod ranges at least as deep as 250 fathoms, but also comes close to shore. There is a general offshore movement in the southern part of their range, at least, with the coming of warm summer waters.

Certain color variations are recognized by fishermen, the "rock cod" being small individuals usually more or less reddish in color and taken not far from shore near rocks and weeds.

The record is over 6 feet with a weight of 211¼ pounds. A fish as high as 75 pounds is unusual but 50 to 60 pounds is not particularly rare.



Haddock

Melanogrammus æglifinus
(Linnæus)

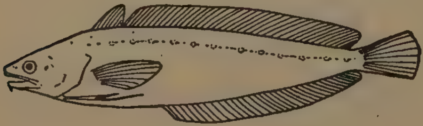
Occurs on both coasts of the north Atlantic south on our coast to New Jersey and in deeper water to off Cape Hatteras.

The food of the haddock is similar to that of the cod.

Spawning occurs from January to June in water from 20 to 100 fathoms, often on the offshore banks. The eggs are buoyant, very slightly adhesive on extrusion and average about 1.5 mm. in diameter. A female may deposit from 100,000 to 2,000,000 eggs, depending on size. They hatch in about 13 days at a temperature of 41° F.

The haddock is apparently less widely distributed than the cod, frequenting water not as shallow nor as deep as cod are sometimes found in, and ranging neither so far north or south. Like the cod, they roam about in search of food, concentrating on their spawning grounds at the proper time.

The usual size of the haddock is from 3 to 4 pounds, but the record is 24½ pounds with a length of 37 inches.



Spotted Ling

Phycis regius
(Walbaum)

Occurs from Cape Fear, North Carolina, to Cape Cod and casually to Halifax in shallow water of less than 200 fathoms.

A bottom fish feeding largely on fish and squid.

Not especially common at any place.

Spawns in December in the southern part of its range.

Reaches a length of about 18 inches.

Florida Ling *Phycis floridanus* Bean & Dressel

Gulf of Mexico, fairly common at times about southern Florida.

Lives in fairly shallow water usually appearing in its greatest numbers close to shore in cold weather.

Reaches probably a foot in length.

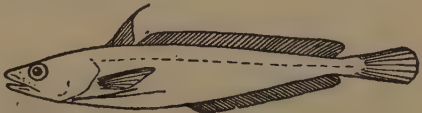
Earl's Ling *Phycis earlli* Bean

A rather rare species in water of moderate depth, on the Atlantic coast south of Chesapeake Bay.

Reaches a length of at least 17 inches.

Boston Ling

Phycis tenuis
(Mitchill)



Occurs from Newfoundland to Cape Hatteras, abundant northward in rather deep water but usually less than 300 fathoms.

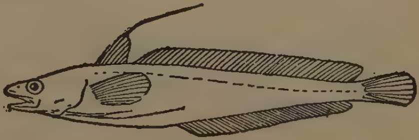
Feeds largely over muddy bottoms on small shrimp, squid and fish. Active at night and on dull days.

Little is known of their life history but ripe fish are some times taken in July in Massachusetts.

Reaches a maximum length of about 3½ feet and a weight of about 30 pounds.

Squirrel Ling

Phycis chuss
(Walbaum)



Occurs from the Gulf of St. Lawrence to Virginia and to a depth of about 300 fathoms.

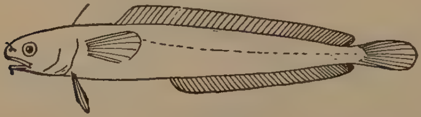
Feeds largely on shrimps, other small crustaceans and fish.

Spawns in summer. The eggs are buoyant, non-adhesive and average about 0.75 mm. in diameter. It is supposed that the young regularly seek shelter within the mantel cavity of the ocean scallop, *Pectin gigantea*.

Reaches a length of 27 inches and a weight of about 8 pounds.

Silvery Rockling *Gaidropsarus argentatus* (Reinhardt)

Recorded from Vineyard Sound, Massachusetts. An arctic species seldom entering our territory.



Four-beared Rockling

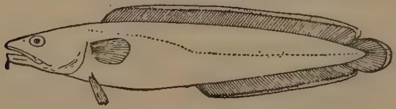
Rhinonemus cimbrius (Linnæus)

Occurs on both coasts of the north Atlantic, south to Rhode Island and in deep water to Cape Fear, North Carolina.

Feeds largely on shrimps and other small crustaceans and mollusks close to the bottom.

Spawning occurs in summer. The eggs are buoyant, non-adhesive and average about 0.75 mm. in diameter.

Reaches a length of 10 inches. Scandinavian specimens have been recorded as high as 16½ inches.



Cusk

Brosme brosme (Müller)

Occurs in the north Atlantic on both coasts south to Cape Cod on our shore and rarely to New Jersey in deep water.

The cusk is a solitary bottom fish occurring in more than 10 fathoms, usually, and down to 500 on the European side at least. It feeds largely on crustaceans and mollusks.

Spawning occurs in spring and summer. A medium sized female may deposit in excess of 2,000,000 eggs. They are buoyant, non-adhesive, brownish or pinkish in color and average about 1.4 mm. in diameter. As with many of these bottom fish laying buoyant eggs the young are pelagic until they reach a length of about 2 or more inches.

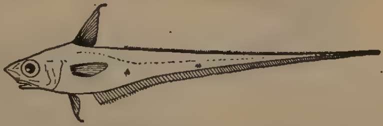
Attains a length of about 3 feet and a weight of about 30 pounds.

The Grenadiers—*Family Macrouridæ*

A large group of deep sea fishes, only one of which has been recorded from our region. They have elongate bodies and tapering pointed tails, 2 dorsals, the first very high and the second scarcely evident.

Rat-tail

Macrourus bairdii Goode & Bean



Occurs from the Gulf of St. Lawrence to the West Indies. A deep sea species known as a straggler in as little as 9 fathoms of water.

A bottom fish usually found over muddy bottoms.

Reaches a length of about 2 feet but usually about half of that.

THE RIBBON FISHES—*Suborder Tæniosomi*

Large oceanic fishes about which little is known. They occur in shore waters sometimes after storms as stranded and usually dead specimens. They are long flat band-shaped fishes and are sometimes described as "sea serpents." Their rarity and scientific interest is such that whenever found some suitable scientific institution should be communicated with at once.

A. Ventral fins reduced, each a single long filament, thickened at the tip; anterior dorsal rays produced; mouth small; caudal fin short or wanting. *The Oar Fishes*, 287.

AA. Ventral fins normally developed or absent; caudal fin short, inserted at an angle to the axis of the body; the tail not much produced beyond it. *The King-of-the-Herrings*, 288.

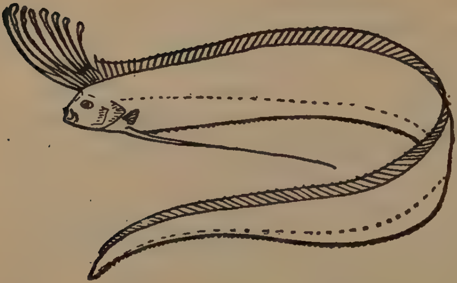
The Oar Fishes—*Family Regalecidæ*

A family of a single species, the characters of which are given in the preceding key.

Oar Fish *Regalicus glesne* (Ascanius)

A surface swimming fish of the open ocean, probably cosmopolitan in distribution. These fish are likely responsible for a number of sea serpent stories.

Known to attain a length of 20 feet.



Oar Fish
Regalicus glesne (Ascanius)

The King-of-the-Herrings—*Family Trachypteridæ*

Deep sea fishes, the characters of which are given in the preceding key. A single Atlantic form.

King-of-the-Herrings *Trachypterus trachypterus* Poey

Known from Cuba but likely to be cast ashore on our southern coast.

Not known to reach a large size.

THE FLATFISHES—*Suborder Heterosomata*

Mostly shore fishes in which the body is flattened from side to side to lie on the ocean floor. The lower side is usually white and both eyes are on the upper side of the head. When flatfish are hatched the young have an eye on each side, as do other fishes, and then swim in a normal fashion, but as they grow, one eye *migrates* over the top of the skull and situates itself close to its mate on the other side and the fish takes up life reclining on one side.

A. Preopercular margin more or less distinct, not hidden by the skin and scales of head; eyes large, well separated; mouth moderate or large; teeth present. *The Flounders*, 289.

AA. Preopercular margin adnate, hidden by the skin and scales of the head; eyes small, close together; mouth very small, much twisted; teeth rudimentary or wanting. *The Soles*, 289.

The Flounders—*Family Pleuronectidæ*

The definition covering this family is in the preceding key. It in turn may be divided into the following subfamilies.

A. Ventral fins symmetrical, similar in position and in form of base, the ventral of the colored side not extended along ridge of abdomen.

B. Mouth nearly symmetrical, the dentition nearly equally developed on both sides, the gape usually, but not always wide. *The Halibuts*, 289.

BB. Mouth unsymmetrical, the jaws on the eyed side with a nearly straight outline, the bones on the blind side strongly curved; teeth chiefly on the blind side (mostly fishes with eyes and color on the right side). *The Flounders*, 293.

AA. Ventral fins unsymmetrical, dissimilar in position and usually also in form, the ventral fin of the eyed side being extended along the ridge of the abdomen (eyes and color on the left side). *The Turbots*, 295.

The Halibuts—*Subfamily Hippoglossinæ*

The definition of this group is covered in the preceding key. It includes the largest of the Flatfishes.

A. Dorsal about 100; anal about 85; body comparatively elongate; caudal fin lunate; lateral line simple; eyes and color on right side.

B. Lateral line without an arch anteriorly. *Greenland Halibut*, 290.

BB. Lateral line with an arch anteriorly. *Halibut*, 290.

AA. Dorsal less than 95; anal less than 75; caudal fin double truncate or rounded, the median rays longest.

C. Lateral line without a distinct anterior arch; eyes and coloration on right side; caudal peduncle distinct; dorsal about 88; anal about 70. *Sand Dab*, 291.

CC. Lateral line with a distinct anterior arch; eyes and color on left side.

D. Scales weakly ciliated; caudal fin with a distinct peduncle; mouth large; teeth unequal, some of the anterior ones canine-like; gill-rakers rather long and slender; no dorsal lobe or produced ventral rays.

E. Gill-rakers 5 + 15 or 16; long and slender, the longest ⅔ of eye; depth of body about 2.2 in length; head about 3.66; dorsal 85 to 93; anal 67 to 73; scales about 108. *Northern Fluke*, 291.

EE. Gill-rakers fewer, shorter and wider set 2 + 8 to 3 + 10.

F. Body ovate, more or less compressed and opaque; depth about 2.33; no distinct definitely placed ocelli.

G. Dorsal 85 to 93; anal 65 to 73; scales about 100 gill-rakers 2 + 10; much shorter than eye. *Southern Fluke*, 292.

GG. Dorsal 70 to 80; anal 54 to 61.

H. Scales about 120; depth about 2.0; head 3.4; gill-rakers 3 + 9. *Florida Fluke*, 292.

HH. Scales about 90 to 100; depth about 2.33; head 3.75; gill-rakers 2 or 3 + 9 or 10. *Gulf Fluke*, 292.

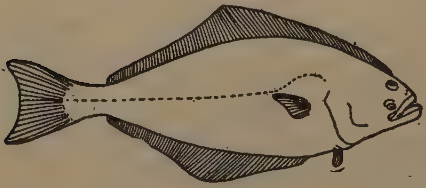
FF. Body oblong, strongly compressed; semi-translucent; depth about 2.25; 4 large distinct black ocelli; dorsal 72; anal 60; scales 93. *Four-spotted Fluke*, 292.

DD. Scales strongly ctenoid; caudal peduncle short; mouth smallish; teeth small and sharp; gill-rakers short and broad; anterior rays of dorsal somewhat produced; left ventral moderately produced; dorsal 70 to 76; anal 57 to 59; scales 83 to 90. *Ocellated Fluke*, 292.

Greenland Halibut *Reinharditus hippoglossoides* (Walbaum)

Arctic Atlantic south to the Grand Banks and probably straying into our region. Not common.

Reaches a very large size.



Halibut

Hippoglossus hippoglossus (Linnæus)

LaMonte, PL. 42

Occurs in northern seas, circumpolar, and southward on our coast to New Jersey, in deep water.

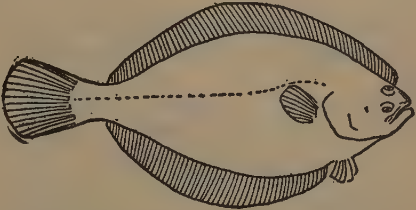
A voracious species preying chiefly on fishes and to a less extent on the larger crustaceans. It tends to keep in roving bands.

The halibut is believed to spawn in February in our territory. A female of about 200 pounds may produce in excess of 2,000,000 eggs. They are pelagic and average about 3.5 mm. in diameter.

Reaches a length of over 9 feet and a weight of about 700 pounds. Over 450 pounds is exceptional.

Sand Dab

Hippoglossoides platessoides
(Fabricius)



Occurs on both coasts of the north Atlantic south to Cape Cod and rarely to Rhode Island.

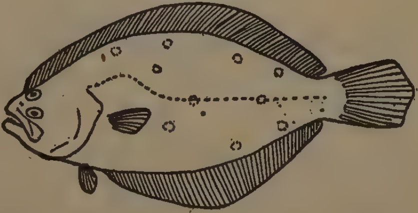
The sand dab tends to keep to sandy and muddy bottoms. It feeds chiefly on various invertebrates.

Spawns from March to June. A single female may produce between 30,000 and 60,000 eggs. They are buoyant, non-adhesive and average about 2.5 mm. in diameter. They hatch in about 12 days at a temperature of 39° F. Probably maturity is reached in about the sixth year. Known to attain an age of between 24 to 30 years.

Reaches a length of about 2 feet and a weight of 7 pounds.

Northern Fluke

Paralichthys dentatus
(Linnæus)



Occurs from Cape Cod to South Carolina. Casually reaches north to Casco Bay and possibly south to Florida.

It tends to move offshore in deeper water with the coming of winter. Widely distributed, being taken on all manner of bottoms. Feeds largely on crustaceans and mollusks and to a lesser extent on fishes.

Reaches a weight of 26 pounds and a length of about 46 inches. Usually not over 5 pounds.

Southern Fluke *Paralichthys lethostigmus* Jordan & Gilbert

South Atlantic and Gulf coasts questionably north to New York.

This species closely resembles the northern fluke.

Reaches about a similar average size.

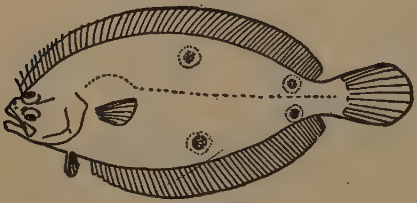
Florida Fluke *Paralichthys squamilentus* Jordan & Gilbert

South Atlantic and Gulf coasts. A rare species which closely resembles the gulf fluke.

Gulf Fluke *Paralichthys albiguttus* Jordan & Gilbert

A common species of the south Atlantic and Gulf coasts.

It does not reach as large a size as other species of this genus.



Four-spotted Fluke

Paralichthys oblongus (Mitchill)

Occurs on the coasts of southern New England and New York, rarely to New Jersey.

Feeds largely on small crustaceans, mollusks and fish.

Spawns in spring in the northern part of its range. The eggs are buoyant, non-adhesive and average about 1.0 mm. in diameter. They hatch in about 8 days at a temperature of 53° F.

Reaches a length of 15 inches and a weight of 13 ounces.

Ocellated Fluke *Ancylopsetta quadrocellata* Gill

South Atlantic and Gulf coasts. An exceedingly handsome species which is not rare. It is marked with 4 ocellated spots usually with white centers and otherwise is variously flecked with white.

The Flounders—*Subfamily Pleuronectinæ*

The definition covering this subfamily is to be found in the subfamily key.

A. Dorsal less than 90; anal less than 65.

B. Lateral line with a distinct arch in front; scales imbricated, rough ctenoid; dorsal 85; anal 62; scales 100. *Rusty Dab*, 293.

BB. Lateral line without a distinct arch in front.

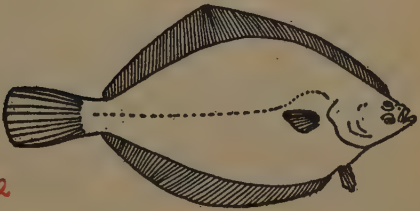
C. Scales regularly imbricated, all (on eyed side) ctenoid; dorsal over 60; anal over 45; scales 83.

D. Dorsal 61 to 67; anal 46 to 50; head 4. *Winter Flounder*, 294.

DD. Dorsal 68 to 73; anal 50 to 54; head 4.5. *George's Bank Flounder*, 294.

CC. Scales imperfectly imbricated and not all ctenoid in female (fin rays scaly in male, naked in female); dorsal 55; anal 40; scales 70. *Smooth Flounder*, 294.

AA. Dorsal 101 to 112; anal 87 to 100; scales all cycloid. *Witch Flounder*, 294.



Rusty Dab
Limanda ferruginea
(Storer)
LaMonte, pl. 42

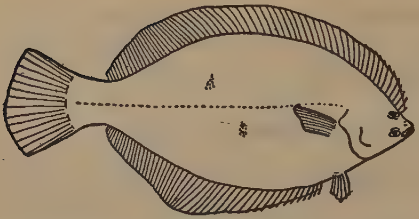
Occurs from Labrador to New Jersey.

Usually found in depths of from 5 to 50 fathoms on sandy bottoms or mixed sand and mud.

Feeds chiefly on small crustaceans, mollusks, worms and fishes.

Spawns in spring and summer. The eggs are buoyant, non-adhesive and average about 0.9 mm. in diameter. They hatch in about 5 days at a temperature of 51° F.

Reaches a length of less than 2 feet.



Winter-Flounder

Pseudopleuronectes americanus (Walbaum)

LaMonte, Pl. 41

Occurs from Labrador to Georgia.

Found on sandy and muddy bottoms to at least 20 fathoms.

Feeds chiefly on shrimps, other small crustaceans, mollusks and small fish.

Spawning occurs in winter when angler's lore has it that they are hibernating in the mud. During this period they feed little if at all. In confinement, at least, they always spawn at night. The eggs are heavy and adhesive and average about 0.78 mm. in diameter. They hatch in about 15 days at a temperature of 39° F. Maturity is probably reached in the third year.

Rarely reaches 15 inches or a weight of 1½ pounds, though there is one on record of 20 inches and 5 pounds.

George's Bank Flounder *Pseudopleuronectes dignabilis* Kendall

A deep water form known only from the vicinity of Georges Bank but usually not occurring below 40 fathoms.

Feeds largely on hydroids and crustaceans.

Spawns in spring.

Reaches a length of about 2 feet.

Smooth Flounder *Liopsetta putnami* Gill

Occurs in shallow water in the north Atlantic south on our coast rarely to Rhode Island.

Supposed to feed on small invertebrates.

Spawns in winter.

Reaches a maximum length of about a foot and a weight of 1½ pounds.

Witch Flounder *Glyptocephalus cynoglossus* Linnæus

A moderately deep water species of the north Atlantic, ranging on our coast from Newfoundland as far south as Delaware Bay along the continental slope.

Feeds mostly on the smaller invertebrates.

Spawns in summer. The eggs are buoyant, non-adhesive and average about 1.10 mm. in diameter. They hatch in about 7½ days at a temperature of 47° F.

Reaches a length of about 25 inches although usually not over 18.

The Turbots—*Subfamily Psettinæ*

The definition covering this subfamily is to be found in the subfamily key.

A. Vomer with teeth; lateral line with a strong arch in front; teeth subequal; body broadly ovate; scales small cycloid; dorsal 65; anal 52; scales 85. *Sundial*, 296.

AA. Vomer toothless.

B. Lateral line with a distinct arch in front; scales small, ctenoid.

C. Dorsal 85; anal 64; anterior profile of head convex before interorbital area. *Eyed Flounder*, 296.

CC. Dorsal 93; anal 70; anterior profile of head concave before interorbital area, the projecting snout leaving a reentrant angle above it. *Peacock Flounder*, 297.

BB. Lateral line without an arch in front.

D. Teeth in upper jaw biserial, in lower jaw uniserial; gill-rakers short; interorbital space broad in males; dorsal 87 to 92; anal 54 to 68. *Small-tailed Flounder*, 297.

DD. Teeth in each jaw uniserial; interorbital space narrow, the ridges coalescing between the eyes.

E. Mouth not very small, maxillary more than 3 in head; scales thin, ciliated and deciduous.

F. Eye 4 in head; dorsal 80; anal 56; scales 41; sides and fins with dark blotches. *Large-eyed Whiff*, 297.

FF. Eye 6 in head; dorsal 75 to 80; anal 58 to 61; scales 45 to 48; sides and fins comparatively plain. *Spot-finned Whiff*, 297.

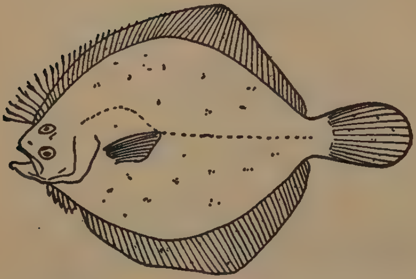
EE. Mouth very small, maxillary less than 3 in head; snout not acute; dorsal 75 to 85.

G. Body comparatively elongate, the depth less than 2.

H. Dorsal 81; anal 58; head 4.25; eye 3.6; maxillary 4. *Small-mouthed Flounder*, 297.

HH. Dorsal 77; anal 61; head 4; eye 3.5; maxillary 4.33. *Florida Flounder*, 298.

GG. Body deep, more than 2; dorsal 76 to 85; anal 56 to 67; head 4.8; eye 3.75; maxillary 4.
Fringed Flounder, 298.



Sundial

Lophopsetta maculata
(Mitchill)

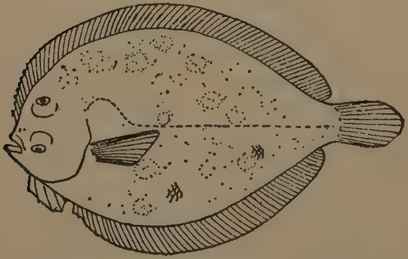
Occurs from South Carolina to Cape Cod, straggling to the Gulf of St. Lawrence.

Found from the shore line down to 40 fathoms, usually over sandy bottoms.

Feeds largely on crustaceans, worms, mollusks and small fish.

Spawns in late spring. The eggs are buoyant, non-adhesive and average about 1.0 mm. in diameter. They hatch in about 8 days at a temperature of 53° F.

Usually less than a foot in length but recorded up to 18 inches with a weight of 2 pounds.

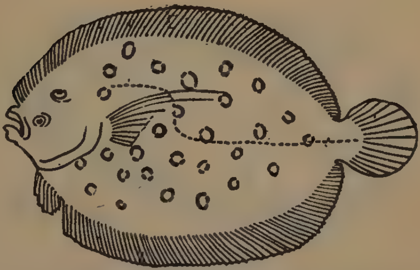


Eyed Flounder

Platophrys ocellatus
(Agassiz)

Occurs on sandy shores from New York to Rio de Janeiro Scarce or accidental north of Virginia.

Reaches a length of about 8 inches.



Peacock Flounder

Platophrys lunatus (Linnæus)

A handsome West Indian species reaching the Florida Keys, where it is frequently common.

Reaches a size of at least 18 inches.

Small-tailed Flounder *Syacium micrurum* Ranzani

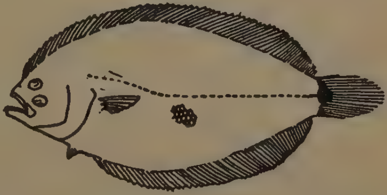
A West Indian species ranging from Key West, Florida, to Rio de Janeiro.

Does not attain a large size.

Large-eyed Whiff *Citharichthys macrops* Dresel

A common south Atlantic and Gulf coast species.

Does not reach a large size.



Spot-finned Whiff

Citharichthys spilopterus Günther

Known from New Jersey to Brazil but not common north of the West Indies.

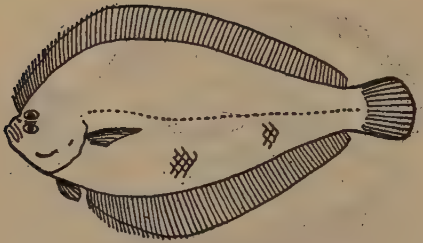
Reaches a length of about 6 inches.

Small-mouth Flounder *Etropus microstomus* (Gill)

A small fragile species often overlooked, so that it is difficult to give a definite range for it.

Sometimes common in the latitude of New York and probably extending to Brazil.

Reaches a length of 6 inches but usually smaller.



Small-mouth Flounder
Etropus microstomus (Gill)

Florida Flounder *Etropus rimosus* Goode & Bean

West coast of Florida in fairly deep water.

A little known and permanently small species.

Fringed Flounder *Etropus crossotus* Jordan & Gilbert

Both coasts of America, northward on the Atlantic side to North Carolina.

The smallest and most feeble of our flounders.

Does not exceed 6 inches in length.

The Soles—*Family Soleidæ*

The definition of this family is covered in the family key.

It is to this family that the sole so valued in Europe belongs. None of the American species are valued as food however. The "filet of sole" of American restaurants is normally made of the winter flounder.

A. Eyes and color on right side (the blind side also usually marked but with a different pattern); body oblong or ovate.

B. Gill openings moderate, confluent below.

C. Pectoral fins small but evident; body scaled.

D. Pectoral fin present on both sides, but the lower one reduced to a single ray; dorsal 53 to 57, anal 40; scales 75 to 80. *Scrawled Sole*, 299.

DD. Pectoral fin present on right side only; dorsal 49 to 58; anal 38 to 44; scales 75 to 85. *Striped Sole*, 299.

CC. Pectoral fins both nearly absent; dorsal 50 to 55; anal 37 to 46; scales 66 to 75. *Hog Choker*, 299.

BB. Gill openings very small, separate, a small slit below angle of opercle; body naked; dorsal 65; anal 45. *Naked Sole*, 300.

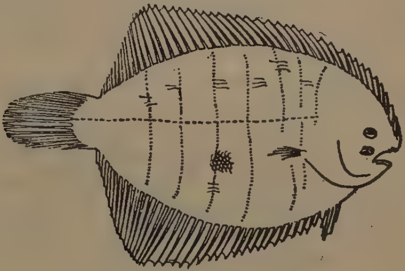
AA. Eyes and color on the left side; body elongate and somewhat lanceolate in outline; no lateral line; dorsal 86 to 95; anal 75 to 80; scales 85 to 93.
Tongue Fish, 300.

Scrawled Sole *Achirus inscriptus* Gosse

West Indies, north to southern Florida.

A not very common species.

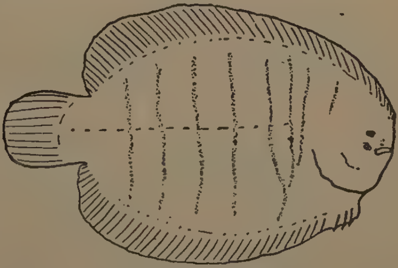
Striped Sole
Achirus lineatus
(Linnæus)



West Indies, north to the Florida Keys.

Fairly common, especially south of our range.

Hog Choker
Achirus fasciatus
Lacépède



Occurs from Cape Ann to the Gulf coast.

Found on sandy or muddy bottoms in shallow water. Runs into brackish and even into fresh water, especially when young.

Feeds chiefly on small organisms and sea weed.

Spawns in the late spring.

Unlike the flatfishes, in our region at least, this form has a definite pattern on each side. The eyed side has transverse lines as shown in the figure and the blind side instead of being the conventional plain white is covered with round dark spots. The significance of this is not understood.

Reaches a length of about 6 inches.

Naked Sole *Gymnochirus melas* Nichols

A little known form described from the Carolina coast.

Another form *G. nudus* has been reported from Woods Hole but the record is questionable. It differs from *G. melas* in that it has a definite pattern of crosswise stripes whereas the latter is uniformly dark, nearly black.

Tonguefish *Symphurus plagiusa* (Linnæus)

South Atlantic and Gulf coasts.

It is replaced to the southward, questionably within our range, by *S. plaguisa* (Bloch & Schneider) which has a mottled dorsal and anal and no distinctly black caudal portion with a light tip, às has the present.

Does not reach a large size.

THE FROG FISHES—*Order Pediculati*

Fishes with a wrist-like joint at the base of the pectoral fin. The gill opening, instead of being in front of the pectoral, as in other fishes, is reduced to a relatively small pore behind it.

A. Mouth large, terminal; gill opening in or behind lower axil of pectoral.

B. Pseudobranchia present; head broad, depressed; mouth enormous and with very large teeth. *The Anglers*, 300.

BB. Pseudobranchia absent; head somewhat compressed; mouth not especially large or armed with very large teeth. *The Frog Fishes*, 301.

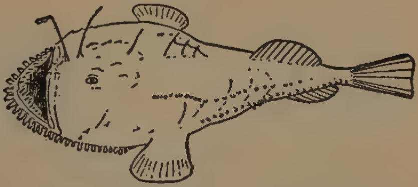
AA. Mouth small, inferior; gill openings in or behind upper axil of pectoral. *The Bat Fishes*, 302.

The Anglers—*Family Lophiidæ*

The characters of this family are given in the preceding key. A single species is found in our range.

Angler

Lophius piscatorius Linnæus



Occurs on both coasts of the Atlantic, on our shores from the Gulf of St. Lawrence to Cape Hatteras and in deep water (outside the continental shelf) to the Cape of Good Hope. By some the American form is considered as a distinct species.

Feeds voraciously on fishes, mollusks, crustaceans and even on diving sea birds. The first dorsal ray has a bait-like tab on its end which is said to be tangled over the gaping mouth to lure fishes while the angler rests quietly on the bottom.

Spawns in late spring and summer. The eggs are buoyant and adhesive, slightly oval and average about 2.3 mm. They float in great masses at the surface which may be as large as a foot or two in width and 40 feet in length with a weight of over 30 pounds.

Reaches a length of 4 feet with a weight of 45 pounds and recorded up to 70 pounds.

The Frog Fishes—*Family Antennariidæ*

The characters of these small active fishes are given in the preceding key.

A. Skin naked and smooth; ventral fins elongate; "bait" on tip of first dorsal spine bifurcate or otherwise modified.

B. "Bait" bifurcate at tip. *Sargassum Fishes*, 301.

BB. "Bait" bulbous, covered with fleshy filaments. *Common Frog Fish*, 302.

AA. Skin covered with prickles; ventral fins short; "bait" on tip of first dorsal spine simple. *Spotted Frog-fish*, 302.

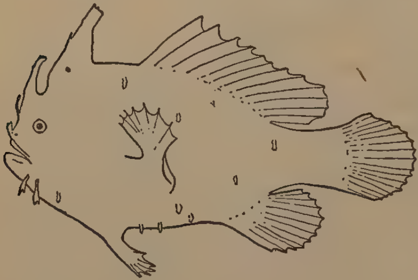
Sargassum Fish *Histrio histrio* (Linnæus)

Occurs in the tropical Atlantic north to Cape Hatteras and as a rare straggler to Massachusetts.

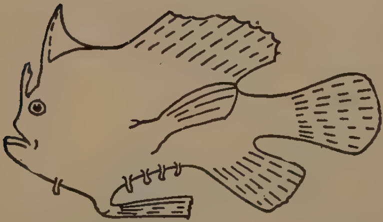
Confined almost entirely to drifting sargassum (gulf) weed. Its shape and coloration are such that it is particularly difficult to see in a mass of weed. In this weed it climbs about with its curious arm-like fins in a very frog-like manner.

The eggs are somewhat similar to those of the angler.

Reaches a length of about 6 inches.



Sargassum Fish
Histrio histrio
(Linnæus)



Common Frog Fish
Histrio gibbus
(Mitchill)

Known from the West Indies north to Key West.

Feeds on small fishes and crustaceans.

Reaches a length about 3 inches.

Spotted Frog-fish *Antennarius ocellatus* (Bloch & Schneider)

West Indies north to Florida.

Just south of our range there are numerous other species which may wander into it. None are strikingly different from the present species.

Reaches a length of about 15 inches.

The Bat-fishes—*Family Ogcocephalidæ*

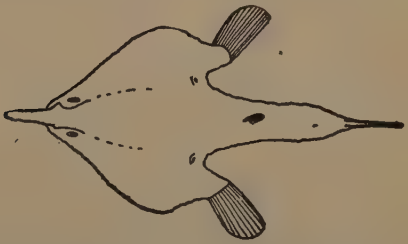
Peculiar depressed fishes defined in the preceding family key. These represent one of the greatest digressions into specialization to be found anywhere in fishes. Just south of our range there are numerous other species which may be expected to appear in it.

A. Snout produced, the rostral process pointed, 6 to 10 in length of body. *Bat-fish*, 303.

AA. Snout short, the rostral process reduced to a button-like tubercle, about 25 in length of body. *Short-nosed Bat-fish*, 303.

Bat-fish

Ogcocephalus vespertilio (Linnæus)



A West Indian species occurring regularly north to Florida, and accidentally, on rare occasions, to New York.

Reaches a length of about 9 inches.

Short-nosed Bat-fish *Ogcocephalus radiatus* (Mitchill)

Florida, especially about the Keys.

Very common in certain shallow bays, chiefly over sandy bottoms.

Reaches a length of about a foot.

GLOSSARY OF TECHNICAL TERMS

This glossary of technical terms, with the aid of the accompanying diagram, gives all information necessary here to aid in identifying a specimen. Terms to be found in an ordinary dictionary have been omitted except in the case of those that have a special meaning in ichthyology. Also those that the amateur or novice is not likely to have need for have been omitted as they are completely covered in some of the more available technical works listed in the bibliography.

Abdominal fins: Said of ventral fins when placed well behind the pectorals and the shoulder girdle to which they are in no way connected, depending entirely from the independent pelvic arch.

Actinosts: The series of bones at the base of the pectoral rays.

Adipose eyelid: The broad fatty eyelid-like covering on the anterior and posterior parts of the eyes of some fishes, in certain cases almost entirely covering the eye.

Adipose fin: The fatty fin-like tab on the back of some fishes placed behind the dorsal fin. Characteristic especially of salmon, catfish and related forms.

Air-bladder: The sac just below the back bone and kidney of most fishes which contains gases. It is homologous with the lungs of higher vertebrates, but functions chiefly as a hydrostatic organ in fishes.

Anadromous: Said of marine fishes that ascend streams to spawn.

Anal fin: The unpaired fin on the median line of the body of most fishes just behind the anus or vent.

Benthic: Dwelling in deep water or on the bottom.

Branchiæ: The gills.

Branchiostegals: The bony rays supporting the membranes under the head below the opercular bones.

Canines: Any conical teeth in the jaws larger and longer than the rest.

Cardiform teeth: Coarse sharp teeth like wool cards.

Catadramous: Said of fresh-water fishes which descend to the sea to spawn.

Caudal fin: The unpaired fin at the posterior end of the body; the tail fin.

Caudal peduncle: The region of the body between the dorsal and anal fins and the caudal fin.

Cephalic fins: The detached part of the pectorals on the heads of certain rays.

Chin: The area at the front of the lower jaw.

Ciliated: Fringed with eyelash-like projections.

Cirri: Fringes.

Claspers: The male reproductive organs of sharks and skates; specialized parts of the ventral fins.

Compressed: Flattened from side to side.

Ctenoid: Said of scales that are rough to the touch. This condition is due to their being minutely spinous.

Cycloid: Said of scales that are smooth to the touch. This condition is due to their edges being entire and without spines.

Deciduous: Said of scales that readily fall off under slight stimulation.

Depressed: Flattened from above and below.

Depth: The greatest vertical diameter of a fish.

Distal: Remote from point of attachment.

Dorsal: Relating to the back. Often used as a contraction of dorsal fin.

Dorsal fin: The unpaired median fin of the back.

Emarginate: Slightly forked, concaved or notched. Usually said of the caudal.

Entire: Smooth edged, without spines or notches.

Erectile: Capable of being raised or erected.

Exserted: Projecting beyond the general level.

Falcate: Shaped like a sickle.

Falciform: Curved like a sickle.

Fluvitile: Dwelling in rivers.

Forehead: Frontal curve of the head.

Furcate: Forked.

Fusiform: Spindle-shaped, or tapering at both ends.

Ganoid: Enameled bony scales or plates.

Gape: The opening of the mouth.

Gill-arches: The bony arches to which the gills are attached.

Gill-openings: The external openings leading to and from the branchiæ.

Gill-rakers: The variously formed bony protuberances along the inner edge of the gill-arch. In some species of fishes these are virtually a fine net work and are used for straining minute food particles from the water.

Gills: The respiratory apparatus of fishes, so constructed as to be able to use the oxygen dissolved in water.

Heterocercal tail: Said of the tail of a fish with the vertebral column extending along its upper margin, usually accompanied by a much larger upper fin lobe. Characteristically seen in the sharks.

Homocercal tail: Said of the tail of a fish with the vertebral column not extending along its upper margin, usually accompanied by a symmetrical tail fin.

Ichthyology: The scientific study of fishes. This science, one of the divisions of zoology is usually divided into three parts, as follows:

I. Descriptive ichthyology, which deals with the identification and classification of fishes and which must form a basis for all other studies.

II. Economic ichthyology, which deals with the relationship of fishes to the interest of mankind and includes fish-culture, conservation and productivity of waters.

III. Philosophical ichthyology, which includes the place and significance of fish in nature, its evolution, its mechanism, et cetera, and is the "purest" phase of the science, although it must be remembered that there is no hard and fast boundary between these three rather arbitrary divisions.

Imbricate: Overlapping, said of scales.

Incisors: Front, cutting, chisel-like teeth.

Interopercle: The bone attached between the preopercle and the branchiostegals.

Interorbital: The region on top of the head between the eyes.

Isocercal: Said of the tail of a fish which gradually tapers to a point and has the vertebræ reducing in size accordingly along the median axis.

Isthmus: The region between the branchial openings on the chest and throat.

Jugular fins: Said of ventral fins when inserted in advance of pectorals with the shoulder and pectoral girdles more or less attached.

Lacustrine: Living in lakes.

Larva: An immature form which must undergo a rapid or more or less protracted change of appearance of an extensive sort before becoming adult.

Lateral line: A series of muciferious openings along the side of the body forming a "dotted line".

Littoral: Dwelling along shores.

Lunate: Said of tails with a broad shallow concave outer margin, somewhat resembling a new moon.

Mandible: The lower jaw.

Maxilla: The upper jaw.

Maxillaries: The outermost bones of the upper jaw, the posterior ends of which move downward when the mouth is opened.

Molars: Grinding teeth, usually posterior in jaws or on the phryangeal bones.

Necton: Large forms of aquatic life (as opposed to plankton) which swim actively and do not simply drift with the currents.

Nictitating membrane: The third or inner eyelid of sharks and skates.

Occipital: Relating to the occiput.

Occiput: Back of the head above.

GLOSSARY OF TECHNICAL TERMS

Opercle: Posterior-most bone on the side of head covering the branchial cavity.

Opercular bones: The exterior bones on the side of the head.

Operculum: Opercle.

Opercular flap: Prolonged upper angle of the opercle of some fishes.

Orbit: Eye socket.

Oviparous: Producing eggs which hatch after extrusion from the female.

Ovoviviparous: Producing eggs which hatch before extrusion from the female.

Palatines: A pair of bones on the roof of the mouth extending out from the vomer and frequently bearing teeth.

Pectoral: Relating to the breast.

Pectoral fins: The front or upper paired fins just behind the head. They are homologous to the front limbs of higher vertebrates.

Pectoral girdle: The bones supporting the pectoral fins; the shoulder girdle.

Pelagic: Living in or on the open sea.

Pelvic fins: The ventral fins.

Pelvic girdle: The bones supporting the ventral or pelvic fins.

Peritoneum: The membrane lining the visceral or abdominal cavity.

Plankton: A collective name for microscopic and very small organisms found freely drifting in open water which forms the direct food of many fishes and the indirect food of nearly all truly oceanic life.

Postorbital: Behind the eye.

Premaxillaries: The bones just in front of the maxillaries, meeting at the symphysis and usually bearing most of the teeth of the upper jaw.

Preopercle: The bone immediately in front of the opercle.

Preorbital: The bones just before the eye.

Proximal: The end nearest the attachment.

Pseudobranchiæ: The small patch of gills attached to the under side of the opercle of many fishes.

Pyloric cæca: The glandular appendages in the form of blind sacs, opening into the alimentary canal at the pylorus or junction of the stomach and intestine.

Ray: Cartilaginous rod supporting membrane of a fin.

Second dorsal: Posterior or rayed part of a dorsal fin in cases where the two parts are separate.

Serrate: With notches like saw teeth.

Shoulder girdle: The bones supporting the pectoral fins; the pectoral girdle.

Soft dorsal: The posterior part of a dorsal fin when composed of soft rays.

Soft rays: Articulated rays of a fin, usually branched and flexible.

Spine: Stiff, usually sharply pointed rods supporting the anterior or anterior part of the dorsal or anal fin.

Spiracles: Small openings in the head or neck of some sharks and skates above.

Subopercle: The bone directly below the opercle.

Suborbital: Below the eye.

Suborbital stay: A bone extending from one of the suborbital bones across the cheek to the preopercle in some fishes.

Supplemental bone: A small bone along the upper edge of the maxillary.

Tetrapod: Four footed; used collectively to separate all the higher vertebrates (with articulated limbs) from fishes.

Thoracic fins: Said of the ventral fins when attached immediately below the pectorals (on the thorax or chest) and with the pelvic and shoulder girdles connected.

Trenchant: Compressed to a sharp edge.

Ventral: Relating to the under surface; often used for ventral fins when pluralized.

Ventral fins: The paired fins below or behind the pectorals, homologous with the hind limbs of the higher vertebrates; the pelvic fins.

Vertebræ: The small ring-shaped bones forming the backbone.

Vertical fins: Unpaired fins on the median plane of the body; specifically, the dorsal, caudal and anal.

Viviparous: Bring forth living young.

Vomer: The median bone forming the front part of the roof of the mouth and often bearing teeth.

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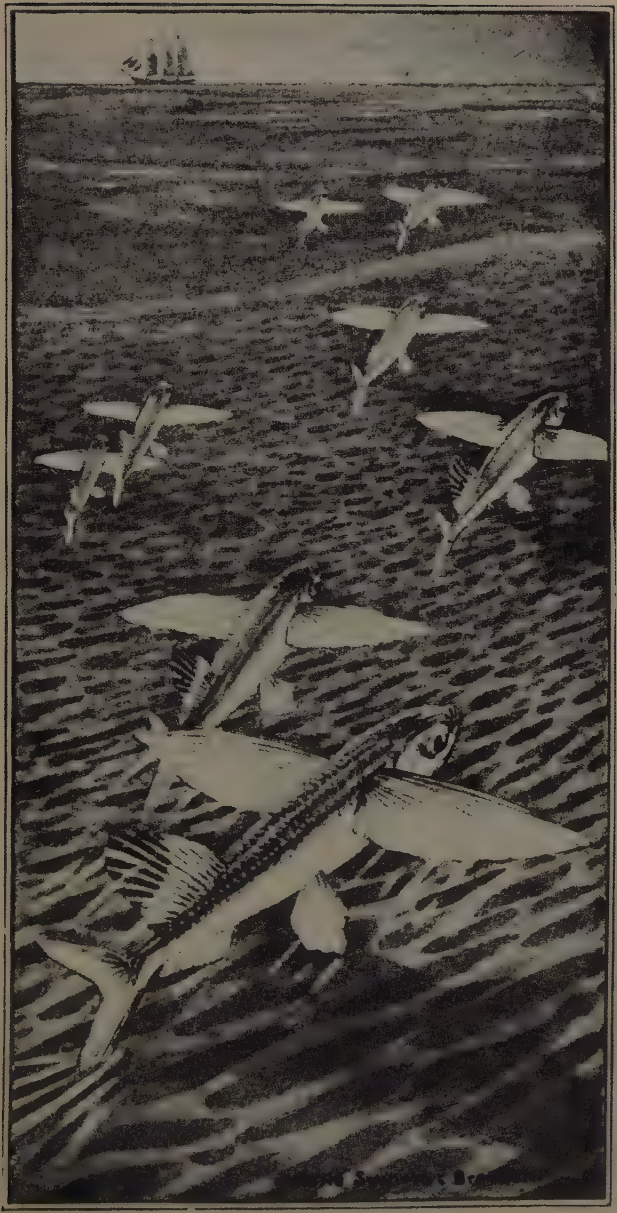
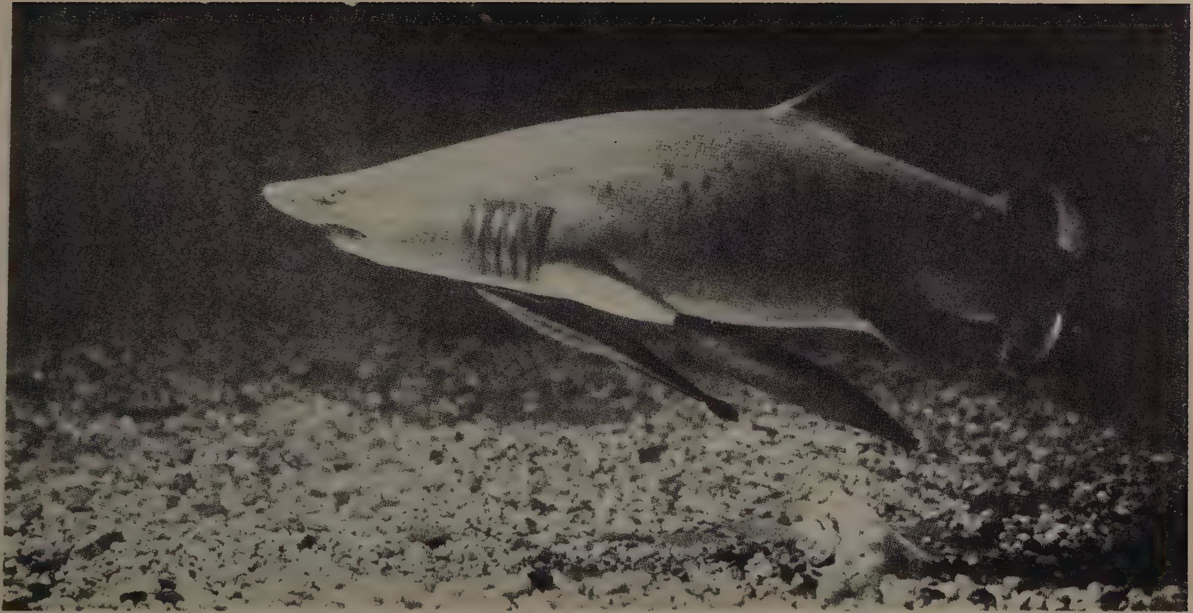


SHORT-WINGED FLYINGFISH, *Parexocœtus mesogaster*



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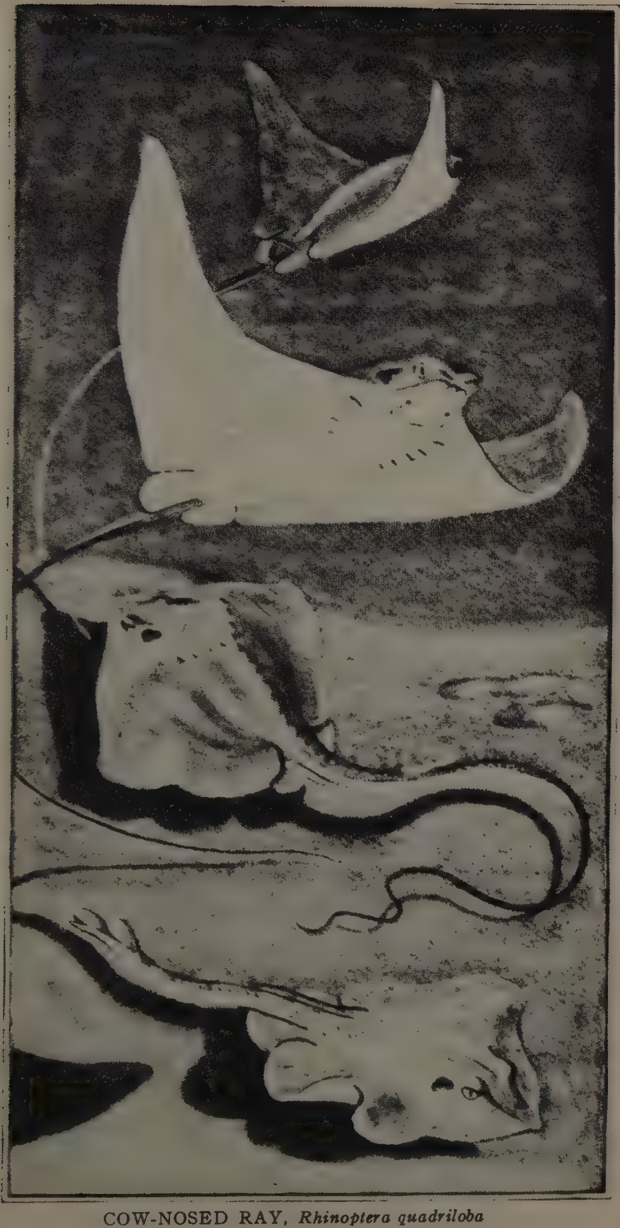
SAND SHARK WITH TWO REMORAS ATTACHED



COW-NOSED RAY, *Rhinoptera quadriloba*
NORTHERN STING RAY, *Dasyatis centrura*
COMMON SKATE, *Raja erinacea*

Photo by Elwin R. Sanborn

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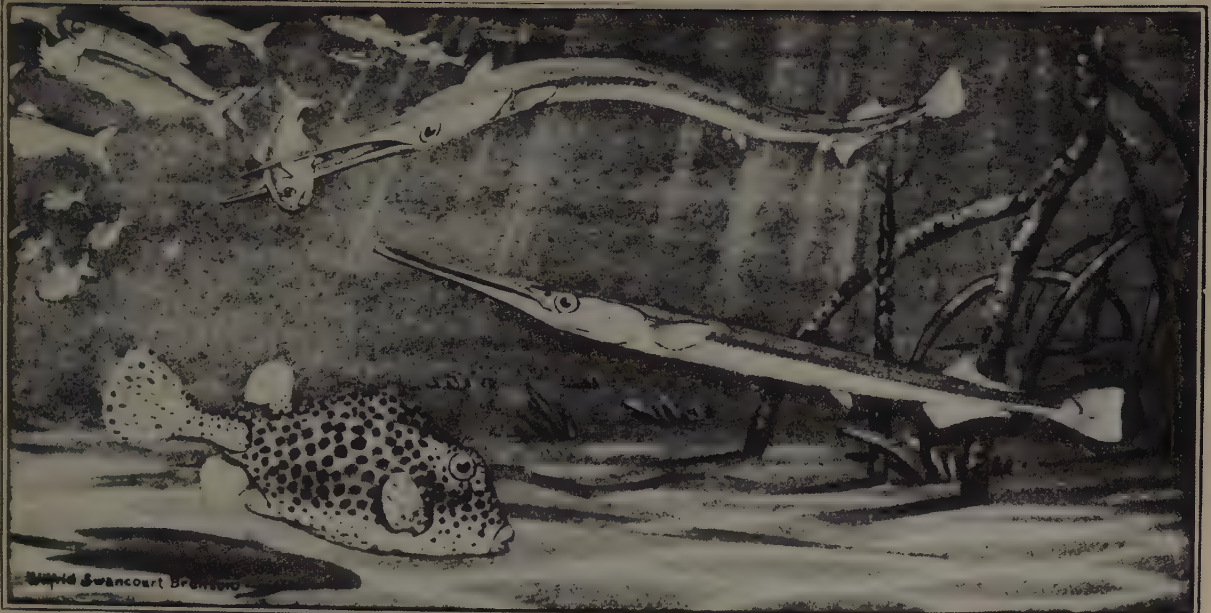
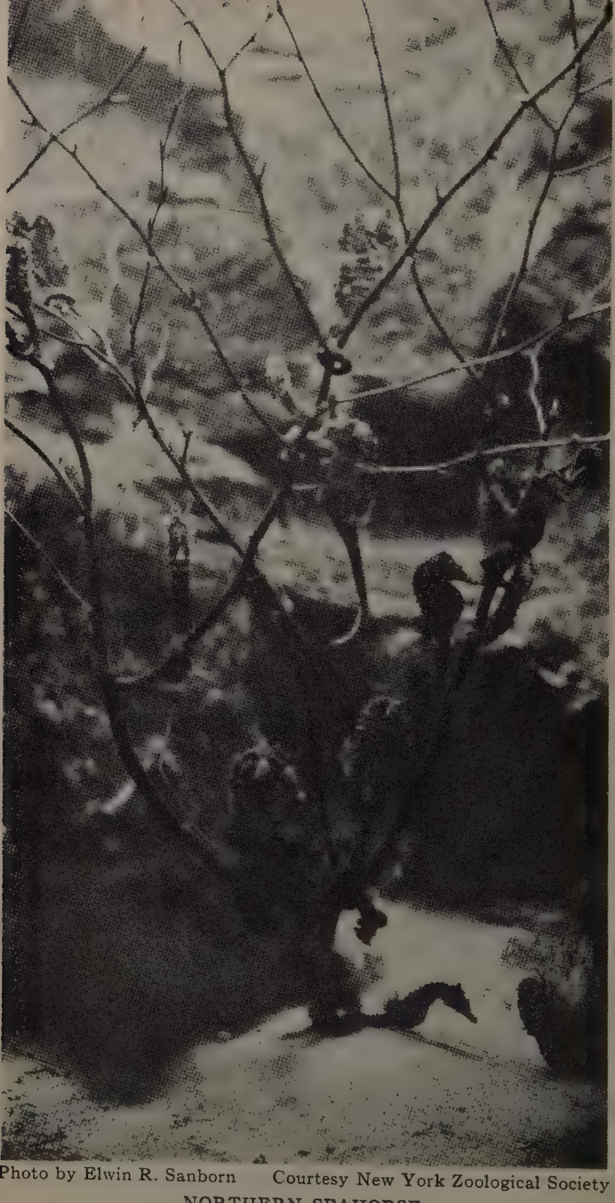


COMMON ANCHOVY, *Anchoviella mitchilli*

BILLFISH, *Strongylura marinus*

SHELLFISH, *Lactophrys bicaudalis*



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NORTHERN SEAHORSE
Hippocampus hudsonius

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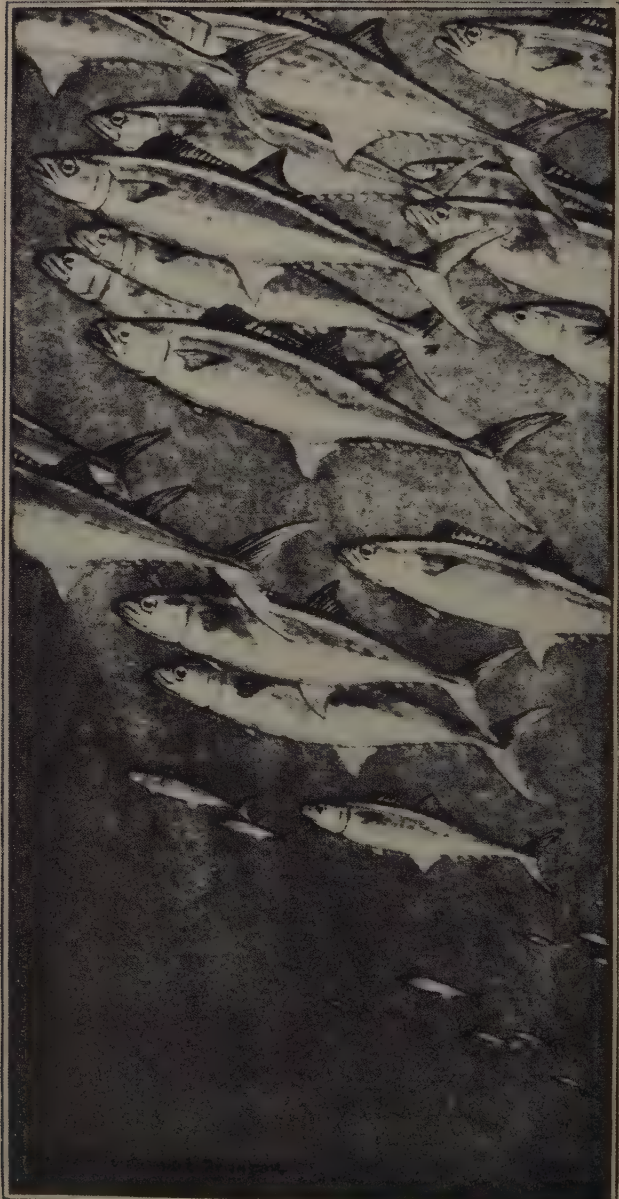
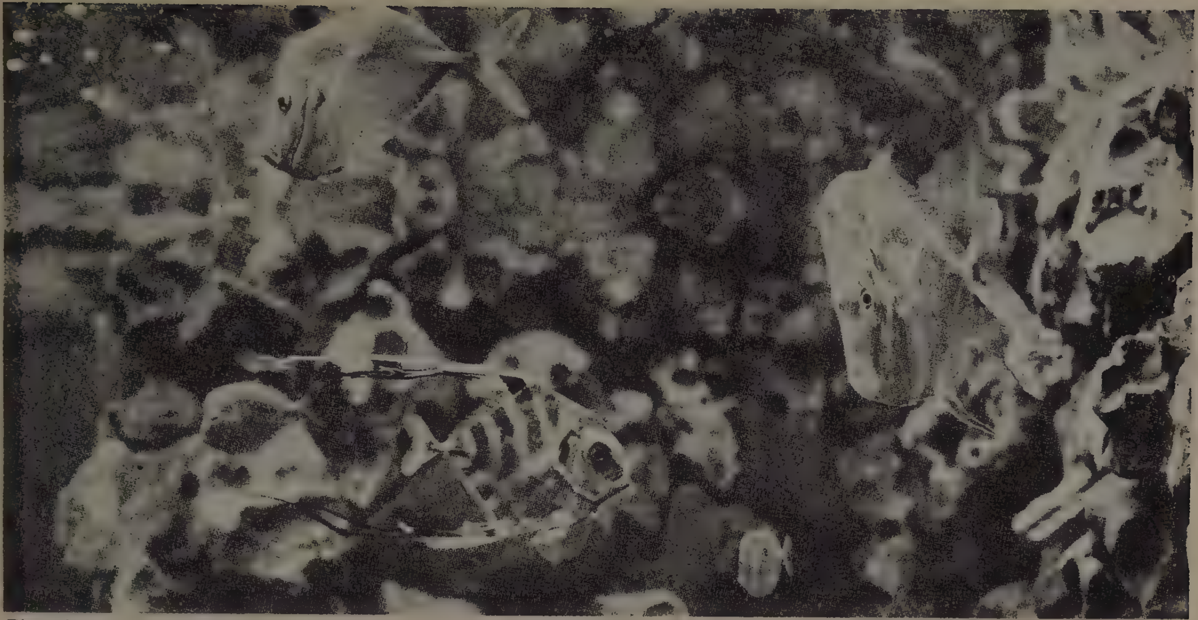
COMMON SQUIRREL FISH

Holocentrus ascensionis



SPANISH MACKEREL, *Scomberomorus maculatus*



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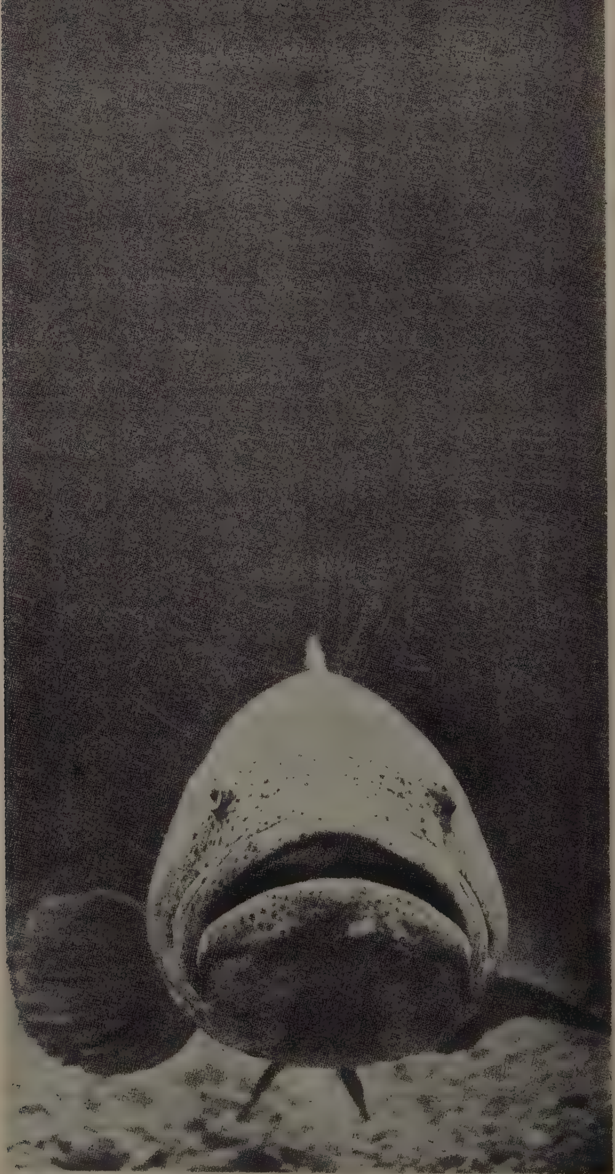
MOONFISH
Vomer setapinnis

THREADFISH
Alectis ciliaris

LOOK-DOWN
Selene vomer



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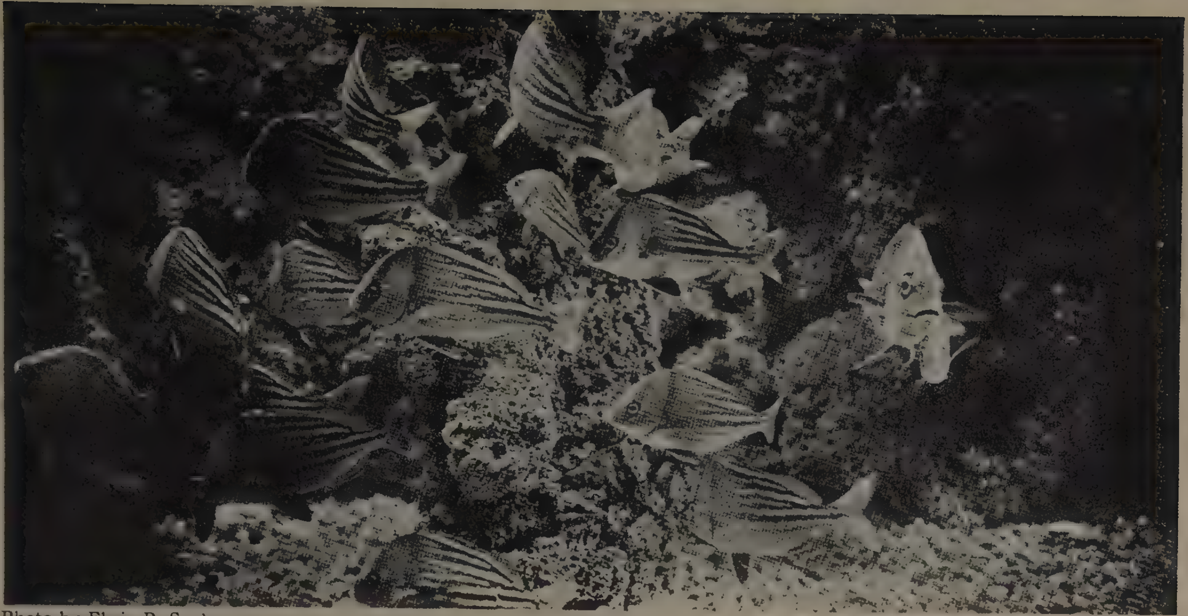
SPOTTED JEWFISH

Promicrops itaiara



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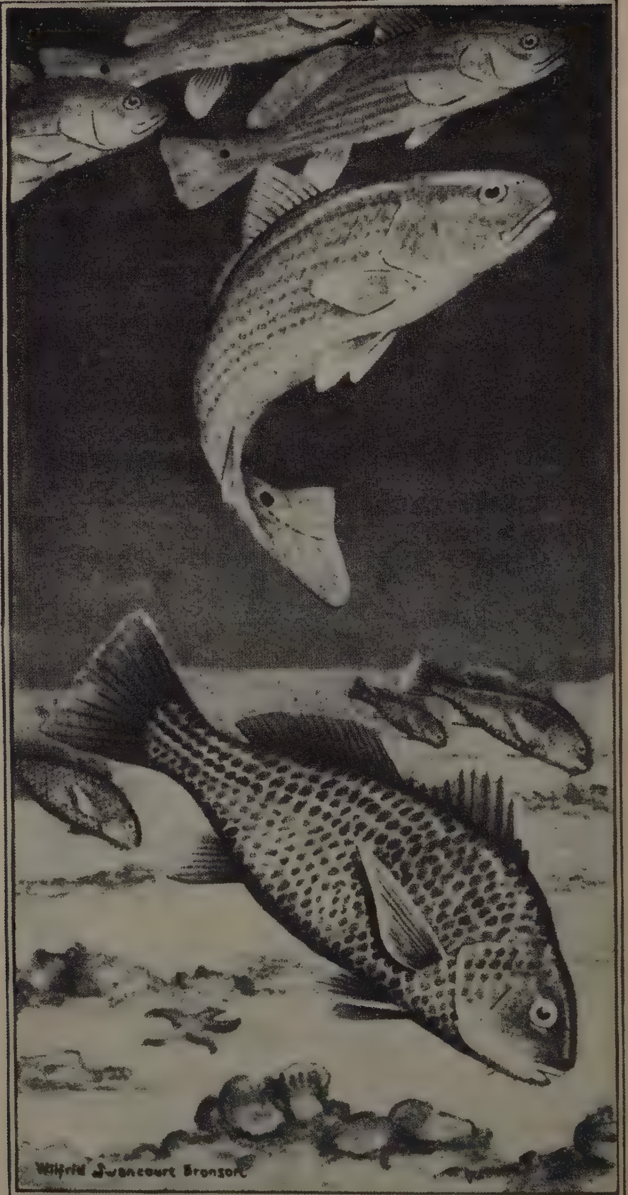
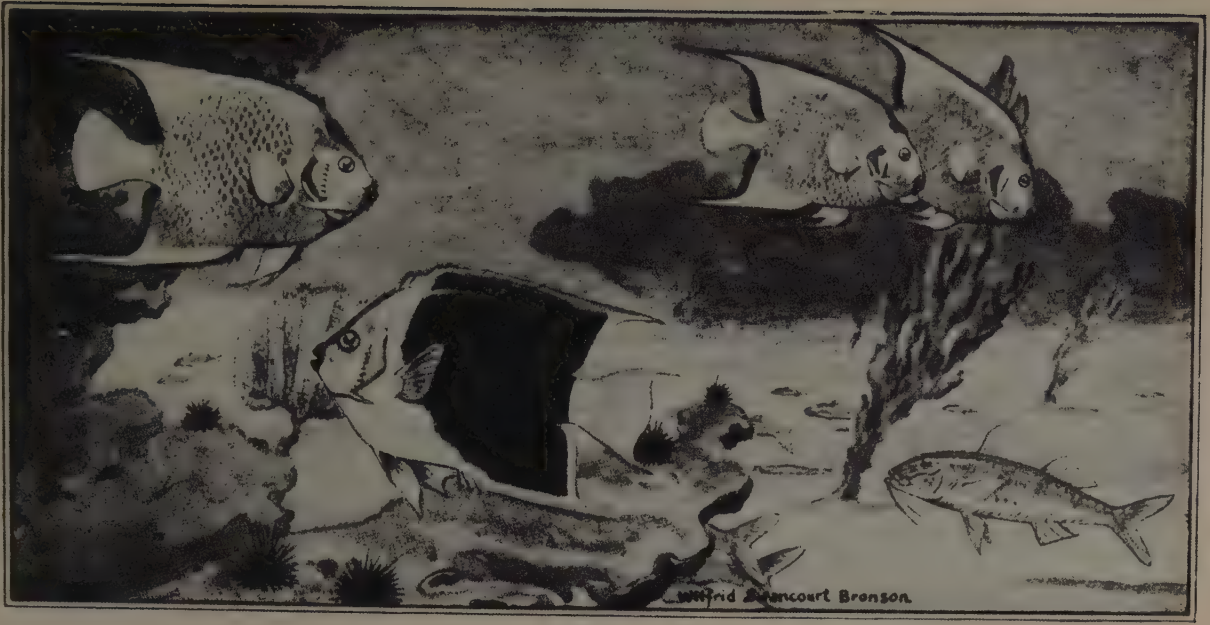
PORKFISH
Anisotremus virginicus



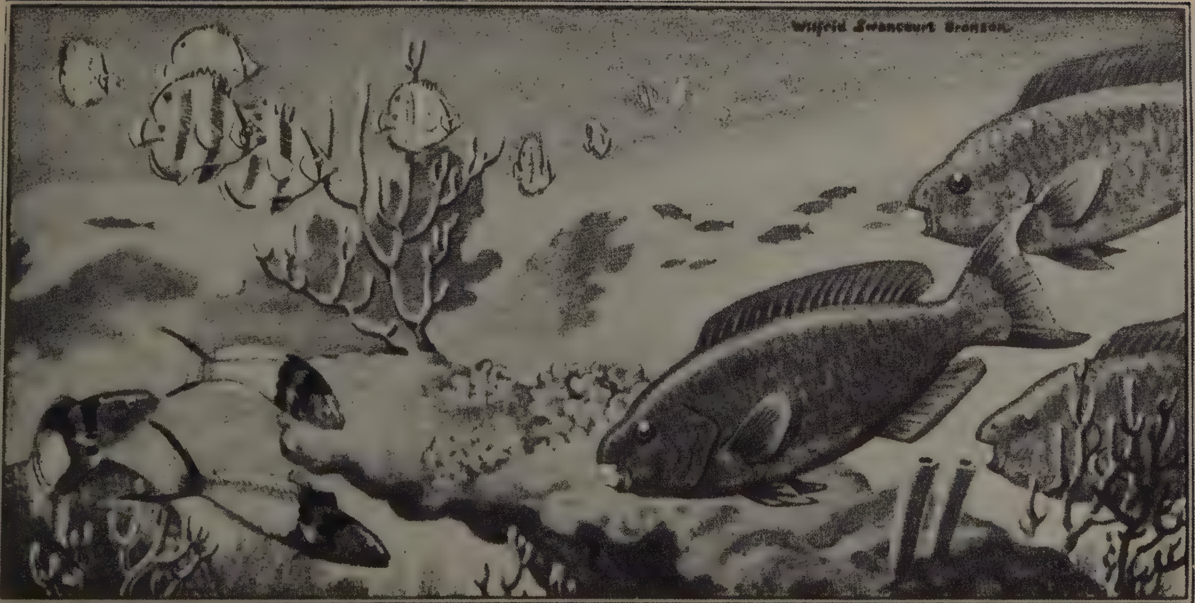
CHANNEL BASS, *Sciænops ocellatus*
SEA DRUM, *Pogonias cromis*



ROCK BEAUTY, *Holocanthus tricolor*

QUEEN ANGELFISH, *Angelichthys ciliaris*

SPOTTED GOATFISH, *Upeneus maculatus*



BANDED BUTTERFLY FISH, *Chætodon striatus*

BLUE PARROTFISH, *Scarus cæruleus*

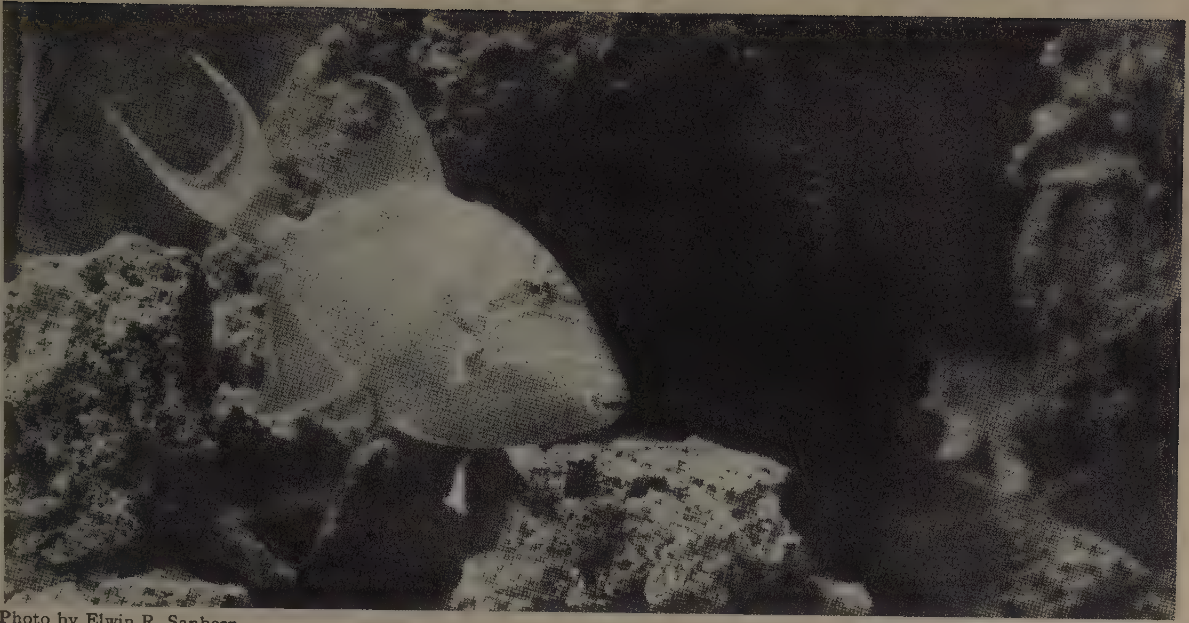


Photo by Elwin R. Sanborn

Courtesy New York Zoological Society

QUEEN TRIGGERFISH

Balistes vetula

TAUTOG, *Tautoga onitis*

COD, *Gadus callarias*

COMMON EEL, *Anguilla*